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A METHOD OF TREATING FRACTURES OF THE FEMUR IN ADULTS

NELSON W. CORNELL, M.D.

Assistant Attending Surgeon, New York Hospital

NEW YORK

THERE are at the present time four generally accepted methods for the treatment of fractures of the femur, namely:

1. Application of plaster of Paris spica.
2. Open operation and application of a metal plate, or bone pegs.
3. Skin traction with suspension.
4. Skeletal traction with suspension.

1. *Application of Plaster of Paris Spica.* This is a method applicable principally to fractures of the neck of the femur and cannot often be used satisfactorily in fractures of the shaft of the bone.

2. *Open Operation.* This method is very effectual in certain types of fracture of the femur, especially those in the middle third of the bone. There is, however, always the danger of carrying in infection by the application of metal plates or bone screws, so that it is a procedure to be avoided whenever possible. In addition, this operation on the femur requires considerable skill and should not be attempted by every surgeon who is called upon to handle such a fracture.

3. *Skin Traction with Suspension.* By suspension is meant slinging the thigh and leg in a Thomas splint with an extension leg piece attachment. Skin traction and suspension are applicable to certain types of cases where the overriding of fragments is not great. Here the difficulties are slipping of the adhesive material, blistering and pulling of the skin, tearing off of the apparatus by the patient, etc.

4. *Skeletal Traction with Suspension.* By this is meant the application of tongs to, or a pin through, the lower end of the femur and suspension in the Thomas splint. This is the method that we have used on our service at The New York Hospital and I believe it is more widely used today than the others cited above. By skeletal traction and suspension better control of the fracture is obtained and the overriding fragments are pulled down with less weight and with less discomfort to the patient.

While this method has been in use on our service over a period of several years and while we have obtained satisfactory end-results in the majority of cases, nevertheless we have found that it has consistently brought out the following difficulties:

(1) Lack of cooperation of the patient.
(2) Mechanical difficulties.
(3) Difficulty with the nursing care.
(4) Discomfort.

(1) *Cooperation of the patient* in any surgical problem is highly essential in order to carry out the proper treatment and this is especially desirable in fractures of the femur.

It has not infrequently been the experience of the House Staff on morning rounds to find that a delirious or excitable patient has torn off his entire apparatus. More frequently the patient "cooperates" by slipping the traction ropes from the pulleys during the night or, unknown to the staff,

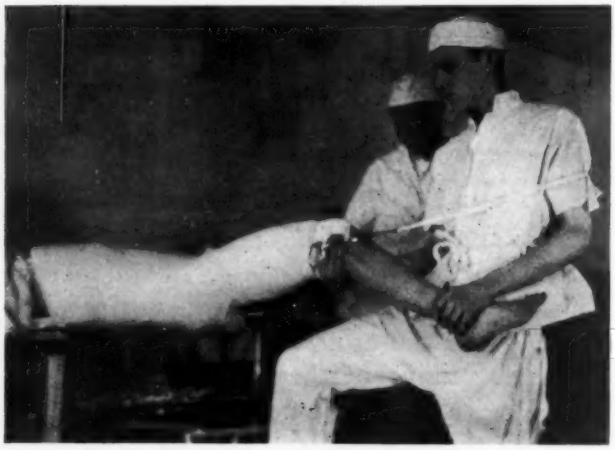

FIG. 1. Application of the first layers of plaster from axilla to knee joint with tongs inserted. Note the angle of flexion at the hip and at the knee joint.

he will have all traction in place for rounds and then as soon as the doctors are out of sight, slip the ropes from their pulleys once more.

Again, it is a very rare patient, indeed, who will move his various joints while under treatment by this method, especially in the early, painful stages. All of these things we have found to be fairly constant factors in the majority of our cases.

(2) *Mechanical difficulties.*

(*a*) Muscle action. It has been most difficult to maintain proper angles at the hip and knee joint to secure muscular relaxation. The angles may be properly adjusted for the moment, but any movement or shifting of the patient may disturb them. Again, a movement by the patient may throw the muscles into spasm, which tends to throw the fragments out of any alignment that has been obtained. With the incomplete relaxation of the muscles we have found it necessary at times to use as high as 40 to 50 pounds' weight to bring the fragments into apposition, and not infrequently the overriding is overcorrected before it is discovered.

(*b*) Alignment of fragments. By the use of Canton flannel strips to support the thigh we have experienced most difficulty in keeping each individual strip at its proper tension on the bars of the splint,

FIG. 2. The wire spade which may be made from an old Thomas splint.

so that the fragments at the site of fracture would not sag or be displaced to either side. We have found no way of keeping these strips from shifting or stretching, while many of the splints will sag and bend inward, due to the tightening of these strips.

(*c*) Facilitation of handling the patient. Roentgenograms made with our portable apparatus have been poor, especially the lateral views.

(3) *Difficulties in Nursing Care.* Care of these patients by the nurses is a problem. A complete change of bedding and mattress is nearly impossible in the early and more

painful stages of the treatment by this method. Likewise, shifting of the patient onto a bed pan is often difficult, due to pain. It is quite impossible to remove the patient from his bed.

(4) *Discomfort of the Patient.* We have found in the early stages of traction and suspension that our patients complain bitterly of the perineal ring which may be too large or too small. It is extremely uncomfortable at best, if any great amount of weight is being used. Motion of the fragments against each other with consequent muscle spasm is another unhappy experience when the patient moves.

Because of the difficulties mentioned above the following method was devised, which, so far as we can ascertain, is original. It is founded on:

1. Skeletal traction by tongs or a pin,
2. Fixation of the hip joint,
3. Control of the knee joint with consequent muscular relaxation,
4. Control of the fragments with plaster of Paris spica during reduction, and their fixation after reduction.

The patient is placed on a Hawley table, anesthetized by gas or ether, then lifted on a sacral rest with the perineal bar in place. Tongs or a Steinmann pin is then placed in the bone just above the condyles under strictly aseptic technique, cutting a small slit through the skin on either side, so that the points of the tongs or pin coming in contact with the bone do not pass through the skin. An assistant then makes strong traction downward on the pin or tongs with the hip flexed to an angle of approximately 140° and abducted only one-half the angle that would be used in a fracture of the neck of the femur. The assistant holds the leg with the other hand, the knee joint being flexed to an angle of 120°. A second assistant makes traction on the other leg sufficient to keep the pelvis from tilting. (Fig. 1.)

Stockinette is then applied, from the axilla to the knee. Rolled non-absorbent cotton covers the stockinette and is in turn covered with crepe paper bandages. All bony prominences are doubly padded. A plaster of Paris spica is then applied from the axillae down to just behind the Steinmann pin or tongs while strong traction and the original angles at the hip joint are maintained.

After several layers of plaster bandage have been applied, an iron bar bent in the shape of a spade is incorporated in the thigh portion of the spica, exactly parallel with the line of the femur. The bar may be made easily from an old Thomas splint which has had the ring removed. (Fig. 2.)

Fig. 3. The leg piece attached, with pulley on end of wire spade and traction over the pulley.

A piece of rope is then passed from the tongs or the pin to the end of the bar and tied. A Pierson extension leg piece is applied, being attached slightly behind the knee joint, with Canton flannel strips to support the leg and a strip of adhesive plaster on the foot to prevent dropping of the toes. (Fig. 3.)

The patient is then placed in a bed on which a Balkan frame has been erected and a rope is tied to the end of the wire spade and up to the Balkan frame, so as to pre-

vent any displacement of the wire downward after the weights have been applied by shifting the pulley from one side to the other, or raising and lowering it.

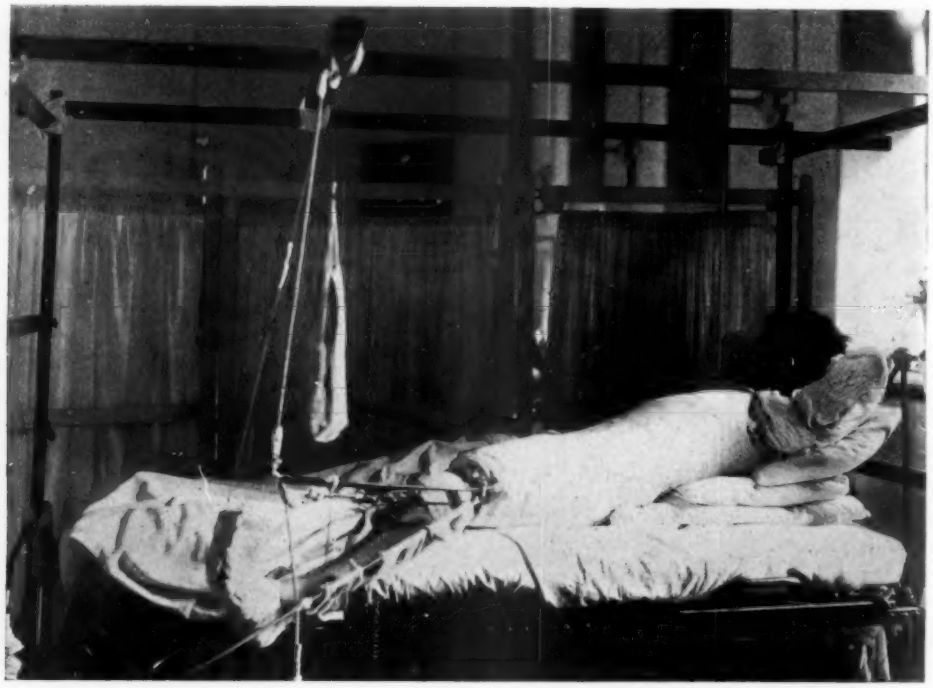

FIG. 4. The apparatus completed, with patient in bed in a semi-reclining position. Note the rope attached from the end of the wire spade to the Balkan frame.

to the traction over the pulley. No traction is placed on the leg. The angle at the knee joint together with its own weight will keep the tibial and femoral surfaces apart as the femur is pulled down. (Fig. 4.)

A weight of 8 to 10 pounds is applied and the lower fragment is amply controlled by shifting the pulley from one side to the other, or raising and lowering it.

The angle at the hip joint allows the patient to be placed in a semi-reclining position with the thigh flat on the mattress and the leg well out of bed. The spica itself put on, as it is, well up in the axillae and with the angle at the hip joint, together with the weight of the patient's

FIG. 5. The plaster of Paris spica completed and tongs removed. The hip joints and knee joints are still in a position of flexion.

own body upon it, is sufficient countertraction for the pull exerted on the tongs or pin. This makes the entire apparatus in one piece with traction and countertraction combined.

Roentgenograms are made frequently until the fragments are pulled into good alignment, which occurs surprisingly soon. After seven to ten days, if the fragments are in satisfactory apposition, with the traction still on, the foot and leg are encased in circular plaster up to the attachment of the skeletal traction.This may be done in three or four days with safety. Anterior and posterior molded splints are then applied to the knee joint to bridge over the gap between the leg and the thigh spicas. This fresh plaster is allowed to harden until there is no danger of disturbance of the leg or thigh and then the pin or tongs are removed. Then there is a complete plaster of Paris spica from the axillae to the toes, with the fracture reduced and firmly held. (Fig. 5.)

Fig. 6. Case cited. Anteroposterior and lateral views of fracture.

The fracture is then roentgenographed from time to time and at the end of six to eight weeks, depending upon the type of fracture and the position, the spica is bivalved, and the fracture site is tested for union. If it is found firm, the entire cast is removed. Following this, baking and gentle massage are begun and the patient is fitted with a walking caliper splint.

From the use of this method the following facts have been learned:

1. Active cooperation of the patient is not necessary, as the apparatus is applied while he is under the anesthetic and it is practically impossible for him to tear it off.

Fig. 7. Anteroposterior view of the same fracture after removal of plaster at the end of eight weeks.

2. Muscle action is reduced to a minimum as muscle rest is obtained by the angles of flexion at the hip and knee joints. These angles are constantly maintained by the plaster spica which eliminates shifting and spasm.

3. Less weight is necessary under this method of treatment; with relaxed muscles, the pull is a gentle, steady one and the fragment is easily drawn down.

4. The plaster spica prevents sagging, buckling and displacement in a lateral plane as the fragments are pulled down.

5. Rapid correction and apposition of fragments and the maintenance of that

position are obtained much more easily than by other methods.

6. Earlier union is secured by the absolute immobilization after reduction, the repair process being undisturbed in the early stages.

7. Early removal of the skeletal traction is possible, so that there may be no danger of bone necrosis and smaller incidence of infection. (The tongs or pins may be removed as early as the second or third day, if there is any evidence of infection.)

8. The whole apparatus, including traction and countertraction, is in one piece, making it a simple mechanical problem.

9. The patient is comfortable after the first twenty-four hours. None of our patients has complained about the fracture site being painful or uncomfortable. They can be moved at will and taken to the *X*-ray Department without disturbing either the fracture or the traction. Likewise, they may be moved to a stretcher for the purpose of changing their beds. In addition, the patient is in a semi-reclining position which is comfortable and after the traction is removed and the plaster spica is completed, they may be turned over in bed. This is especially important in old people.

10. The nursing care is much simplified by the fact that the position of the patient can be shifted.

11. The problem that these cases presents to the staff is likewise simplified, for once the patient is put in this apparatus he does not have to be touched again until the traction is removed and the spica completed. After the latter is done, the job is practically finished.

It will probably be justly said of this method that the complete immobilization in plaster gives rise to loss of muscle tone from the lack of exercise and danger of injury to the joints. So far we have experienced no greater atrophy and loss of muscle tone in this apparatus than when the Thomas splint with traction was used. As for joints, limitation of motion was found to be less than in other methods where the joints were supposed to have been kept active by motion.

I will cite one illustrative case on which this method was used and which was controlled by it, when it seemed at first the fracture would have to be operated on:

M. P., female, aged sixty-eight years, admitted with a long spiral fracture of the lower and middle thirds of the right femur, the ends of the fragments overriding about 2 inches and forming an angle of about 90°. The leg and lower thigh were completely externally rotated and were practically flail. (Fig. 6.)

Under gas anesthesia the apparatus was applied. Good reduction of the fragments was obtained with 10 pounds' traction, and on the tenth day the plaster spica was completed and the tongs removed. The patient had the benefit of a semi-reclining position throughout this period, which, at her age, we consider most important in order to avoid pulmonary complications. After the plaster was completed the patient was turned on her face three times a day for a period of from one-half to one hour and, although her general condition was very poor, being incontinent, involuntary and refusing food part of the time, she had no pulmonary complications.

At the end of eight weeks the plaster was completely removed and solid union was found. (Fig. 7.) Anatomical and weight-bearing position of the fragments was very good. There was no shortening of the femur. Passive motion of the right knee joint was equal to that of the left, with full flexion and extension. Active motion was present and increased by daily exercise and massage.

At the end of ten weeks the patient was ready to wear a walking caliper. This was delayed somewhat by her feebleness.

This was one of the most difficult types of fracture of the femur, yet it responded to this type of treatment very successfully. We have tried it on two other cases of fractured femur with equal success. A series of cases will be reported later.

CONCLUSION

This method is not offered as a cure-all for fractures of the femur, but is proposed as a means of overcoming difficulties that are encountered in the treatment of these fractures.

This method is also applicable to bad fractures of both bones of the leg by the use of a Steinmann pin through the os calcis and a series of such cases will be reported later.

I wish to express my gratitude to the other members of the Attending Staff and also to the House Staff for the many ways in which they have aided me in this work.

[SURGICAL SUGGESTIONS]

THE stomach tube is a valuable therapeutic instrument in the armamentarium of the surgeon, pre- and post-operatively. Empty the stomach in all cases of peritonitis or intestinal obstruction before operating. Empty the stomach in all cases of undue vomiting after operation.

PERSISTENT postoperative vomiting is sometimes due to acidosis from insufficient feeding.

IN SEEKING a cause for inguinal adenopathy examine the anus and lower rectum.

MULTIPLE FRACTURES
REPORT OF TWO UNUSUAL CASES

FREDERICK CHRISTOPHER, M.D., F.A.C.S.
Attending Surgeon, Evanston Hospital
EVANSTON, ILL.

THE term "multiple fractures" may apply to the simultaneous fracture of one bone in several places or of several different bones. In the first and second series of the Index Catalogue of the Library of the Surgeon General, numerous cases were listed under the heading "multiple fractures." This classification, however, fails to appear in the third series (Fractures, 1925). Most writers on fractures recognize and define this term (Stimson,[1] Speed,[2] Eisendrath,[3] Da Costa[4]).

Patients with multiple fractures have generally been subjected to such tremendous violence that many of them die almost immediately after the injury. This may account for the relative rarity of these cases in hospital statistics. Once admitted to the hospital the shock is generally the outstanding feature and should be treated first irrespective of the fracture therapy.

Strictly speaking, many of the pathological fractures are multiple. Scudder[5] classifies these fractures as follows:

A. Symptomatic fragilitas ossium (alterations in strength of bone by local conditions)

(1) New growth (sarcoma, carcinoma)

(2) An infectious or inflammatory process (infections: osteomyelitis, tuberculous osteomyelitis, syphilis, syringomyelia)

(3) Osteomalacia

(4) Rickets

B. Idiopathic fragilitas ossium

(1) Osteogenesis imperfecta (brittle bones)

Greenthal[7] reported an infant aged three months having infantile scurvy and hereditary syphilis. This patient had multiple fractures of both tibiae and femora just proximal to the epiphyses of the lower ends.

Joseph-François Malgaigne, who published his treatise on fractures[6] in 1847, found that of 2358 fractures at the Hotel Dieu, 30, or 1.28 per cent, were multiple. Malgaigne said that he "happily saved from oblivion" one of Dupuytren's ideas, namely "that the danger of wounds and of fractures, although doubtless increased by an increase in their number, is still not in direct ratio with that number . . . when there are several fractures each one induces slighter symptoms than if it were by itself." He believed that consolidation occurred more readily in multiple fractures.

In 1907 Ashhurst[5] wrote an excellent paper on multiple fractures, dealing particularly with those of the upper extremities. From 1902 to 1906 there were 5057 fractures at Episcopal Hospital in Philadelphia. Of these, 73, or 1.44 per cent, were multiple. Omitting amputations and fatal shock cases, the multiple fractures had a mortality of 27.4 per cent.

Ashhurst classified multiple fractures as follows:

I. Fractures of the skull or trunk and the extremities

II. Fractures of different extremities

(a) Similar (e.g., both legs, both clavicles, etc.)

(b) Dissimilar (e.g., leg and forearm, etc.)

III. Multiple fractures confined to one extremity.

Ashhurst collected Malgaigne's and his own cases, together with those in the Surgeon General's Catalogue (Series I and II) and compiled the following table:

DISTRIBUTION OF MULTIPLE FRACTURES (*Asbburst*)

	Malgaigne	S. G. Office Series I	S. G. Office Series II	Episcopal Hospital, Philadelphia	Total	Per Cent
I. Skull or trunk and extremities:						
Skull and extremities	7	13	8	11	39	16.25
Trunk and extremities	3	38	6	10	57	23.75
Skull and trunk	1	8	3	1	13	5.41
Trunk alone	0	5	3	2	10	4.20
II. Different extremities:						
Similar lesions	10	6	6	7	29	12.08
Dissimilar lesions	6	20	9	35	70	29.16
III. One extremity:						
Upper extremity	0	7	1	7	15	6.25
Lower extremity	3	3	1	0	7	2.90
Total	30	100	37	73	240	100.00

Taylor's case[7] is worthy of mention. In it there were fractures of (1) left humerus, surgical neck; (2) left humerus, middle of shaft; (3) left radius; (4) left ulna; (5) right humerus; (6) right radius, upper third; (7) right radius, lower third; (8) right ulna. This patient recovered.

REPORT OF CASES

CASE I. A. F., aged forty-nine, was admitted to the Evanston Hospital on July 3, 1926. He had fallen or been thrown between two cars of an electric train. He had evidently been struck by the car and the wheels had passed over the left leg. Save for a few strands of fibrous tissue and skin there was a traumatic amputation 2 or 3 inches above the ankle joint. When first seen about thirty minutes after admission there was no bleeding from the wound. The patient was warm, had an excellent pulse, and was well oriented mentally. Tetanus antitoxin was given. He was taken to the operating room and a circular amputation was done at the middle third of the leg. The postoperative course was difficult owing to an acute dilatation of the stomach which was evidenced by repeated vomiting beginning shortly after the operation. A stomach tube revealed a large quantity of dark brown fluid in the stomach. Gasric lavage was done repeatedly (seven times in all) and this complication was remedied.

The postoperative pulse averaged 80 and the temperature 99° F. In view of the patient's poor condition roentgenography was deferred until some days later. Dr. E. L. Jenkinson, the roentgenologist, discovered the following multiplicity of fractures (the fractures of the tibia and fibula are included for completeness although they were not roentgenographed):

1. Fracture of left tibia (compound comminuted).
2. Fracture of left fibula (compound comminuted).
3. Fracture of the body of the fourth lumbar vertebra (compression fracture with dislocation backward).
4. Fracture of articular process of the fourth lumbar vertebra.
5. Fracture of spinous process of second lumbar vertebra.
6. Fracture of spinous process of third lumbar vertebra.
7. Fracture of left transverse process of first lumbar vertebra.
8. Fracture of left transverse process of second lumbar vertebra.
9. Fracture of left transverse process of third lumbar vertebra.
10. Fracture of left transverse process of fourth lumbar vertebra.
11. Fracture of right transverse process of fourth lumbar vertebra.
12. Fracture of right transverse process of fifth lumbar vertebra.
13. Fracture of eighth left rib posteriorly.
14. Fracture of ninth left rib posteriorly.
15. Fracture of tenth left rib posteriorly.
16. Fracture of eleventh left rib posteriorly.
17. Fracture of twelfth left rib posteriorly.
18. Fracture of eighth left rib in mid-axillary line.
19. Fracture of ninth left rib in mid-axillary line.
20. Fracture of tenth left rib in mid-axillary line.
21. Fracture of eighth left rib at spinal articulation.
22. Fracture of ninth left rib at spinal articulation.
23. Fracture of tenth left rib at spinal articulation.
24. Fracture of eleventh left rib at spinal articulation.
25. Fracture of eighth right rib posteriorly.
26. Fracture of tenth right rib posteriorly.
27. Fracture of eleventh right rib posteriorly.
28. Fracture of tenth right rib posteriorly (different from fracture No. 26).

It will be seen from the above that the

patient had ten fractures involving the spine, sixteen fractures involving the ribs, and two of the extremities. Although there was considerable dislocation of the fractured fourth lumbar vertebra, fortunately no cord symptoms ever developed. At first no treatment of the spinal injuries was attempted owing to the patient's poor condition and the fear of bed sores. Later, however, when the patient was allowed up in a wheel chair, a Taylor spine brace was applied. This was removed at night. The chest was not strapped with adhesive plaster. The amputation wound, which had been left wide open, gradually closed down and healed completely. A temporary artificial leg was fitted by an artificial leg maker and the patient was allowed up on crutches on the seventy-second day after admission and encouraged to use the stump.

The patient was given a vigorous course of physical therapy including radiant light and heat, massage and exposure to the ultraviolet ray.

He continued to improve in strength and health until, on the one-hundred and fortieth day after admission, he was discharged from the hospital. At this time, although still requiring the aid of crutches, he was able to get around easily, and was able to dress himself and put on his artificial leg.

Case II. F. J. M., male, aged forty-seven years, on October 30, 1916, when attempting to raise the window in a lavatory on the tenth floor of an office building in New York where he was employed as a janitor, lost his balance and fell out of the window. He was intoxicated. He tumbled down an air and light shaft the entire ten stories, doubtless bouncing from side to side as he fell. At the bottom he broke through an angle-iron grating, striking his perineum on the upturned nozzle of an automatic sprinkler. The impact against the sprinkler automatically turned in a fire alarm, and when I arrived in a New York Hospital ambulance, the fire department was already there. The firemen finding an unconscious man turned the fire hose on him and revived him, much to his astonished indignation.[8] The patient was admitted to Bellevue Hospital to the service of Dr. John A. Hartwell. Here it was found that in addition to the lacerated wound of the perineum the patient had sustained the following fractures:

1. Comminuted fissure fracture of the right humerus, compound.
2. Comminuted fissure fracture of left tibia, through malleolus and without displacement of fragments.
3. Fissure fracture of right radius (distal end).
4. Fracture of tip of styloid process, right ulna.
5. Fracture of right fourth rib, posteriorly.
6. Fracture of right fifth rib, posteriorly.
7. Fracture of right sixth rib, posteriorly.
8. Fracture of right sixth rib, in mid-axillary line.
9. Fracture of right seventh rib in posterior axillary line.
10. Fracture of proximal phalanx of left little finger.

On admission the perineal wound was sutured and five days later a cast was applied to the left foot and ankle and a splint to the left little finger. The right chest was strapped with adhesive. Two weeks after admission the patient was up in a wheel chair and on the twenty-eighth day was discharged from the hospital and referred to the Out-Patient Department for further treatment.

Of interest in this case is the fact that, despite the great violence involved, the injuries were not greater, and the shock was minimal or absent.

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THE DEVELOPMENT OF OUR KNOWLEDGE OF THE THYROID GLAND*

J. H. MEANS, M.D.

BOSTON

IN a paper of this sort it is usual, I believe, to present the results of a study of a group of cases, or of a piece of original research; I have certain misgivings, therefore, in departing from such a custom.

The research which I have to report is a literary one, and I fear superficial at that. Nevertheless I venture to hope that, in the midst of the discussion of the goiter problems of the day, it may be profitable to pause for a moment to consider the sources from whence our present conceptions have been derived. To attempt to give in a brief space even the scantest summary of the colossal literature on the thyroid would manifestly be absurd. What I wish to do is merely to point out certain high sports in thyroid history and indicate their bearing upon the various theories regarding the thyroid body in health and disease that we hold today.

In the first instance, as often happens in the medical sciences, an understanding of normal thyroid function was gathered largely from the study of thyroid disease. It was through its pathological enlargement that the thyroid first became known in antiquity, and until the nineteenth century thyroid literature deals largely with simple or endemic goiter. The account given of the anatomy of the gland by Thomas Wharton[1] in his "Adenographia," published in London in 1656, is worthy of mention by reason of its accuracy, and his interpretation of function is of interest because of the perspicacity it illustrates. Wharton was impressed, for one thing, by the extreme vascularity of the organ, and he seems to have had some glimmering of its function in that he at least suggests that it contributes some substance to the blood; to be sure he thought it was a waste product or superfluous humor, but even so the notion is prophetic. The germ of the idea of internal secretion seems to have been in the mind of Théophile de Bordeu,[2] who in 1776 set forth his belief that not only every gland but every organ of the body elaborates a specific substance or secretion which passes into the blood stream, and that upon these secretions the physiological integration of the body as a whole depends. Certain pharmaceutical concerns apparently would like us to believe this in its entirety today.

The strictly chronological method will not best serve the purpose of tracing the significant advances in thyroidology, because there are several distinct lines, divergent at first, but always drawing closer together, by which these advances have been made. For convenience we may recognize an exophthalmic goiter group and a hypothyroid group. The former, which is historically older, includes the recognition and description of the syndrome, speculation as to its causation, and finally conclusions, based on the histological evidence of hyperplasia, the analogous effects of thyroid feeding and the curative ones of thyroidectomy, which show that the overactivity of the thyroid plays an important rôle. The latter comprises the gradual recognition that in the related syndromes, endemic and sporadic cretinism, myxedema and cachexia strumipriva, we have the common factor of thyroid lack, the production of an identical syndrome in animals, and the discovery

* Read at the Annual Meeting of the American Association for the Study of Goiter, February 1, 1927.

that all may be ameliorated or abolished by the feeding of thyroid gland.

The work of Flajani,[3] Parry,[4] Graves[5] and Basedow[6] is familiar to all. Parry and Graves both gave good descriptions of the clinical picture of exophthalmic goiter. Basedow gave a better one. In interpretation Graves made an advance over Parry in that he believed that the heart's affection was purely functional. He furthermore realized that the thyroid enlargement in this disease is of quite a different nature from that in ordinary goiter. He also was aware of the extreme vascularity of the thyroid, as Wharton was, and believed that it might often become suddenly enlarged. He even compared it to erectile tissue, and wondered whether the symptoms of globus hystericus might not sometimes actually be due to a sudden engorgement of the thyroid.

Basedow's description is masterly. With the exception of the distinct mention of tremor, there is little in the way of symptomatology as we know it today that is lacking in his account. It is also significant that he found iodine helpful in the treatment of his patients. Unfortunately he does not give the dosage. This is undoubtedly the first use of iodine in exophthalmic goiter (1840). Twenty years before, Coindet[7] (1820) had reported the diminution in the size of simple goiters upon the administration of iodine salts, and since antiquity iodine-containing sea weeds and sponges had been used in the treatment of the latter disease.

The great French clinicians of the mid-nineteenth century, Trousseau, Marie and Charcot, all gave detailed and accurate descriptions of the symptoms and signs of this malady. Marie in 1883,[8] confirmed by Charcot in 1885,[9] added tremor as the fourth cardinal manifestation; the previous three, called after Basedow the Messeburg triad, were goiter, exophthalmos and increased heart action.

At this time theorization as to the cause of exophthalmic goiter centered chiefly about the nervous system. The disease was regarded as a neuropathy, with the limelight focussed for the most part upon the vegetative system. Marie, however, points out that an affection of the vegetative system alone is insufficient to account for all the manifestations, the cerebral for example, and prefers to regard it as what might be termed a neurosis of the entire nervous system. Note should be made here of the attempt by Filehne[10] in 1879 to produce the disease experimentally. By traumatizing or cauterizing the corpora restiformia in rabbits, he claims to have produced tachycardia and exophthalmos, and in one instance goiter. He thought all these changes were either vagus or vasomotor in origin; he laid the exophthalmos to engorgement of the vessels at the back of the orbit, the goiter to engorgement of the thyroid. This may well be a portion of the truth, but of course it is not all. The experiments of Cannon,[11] however, in 1914, in which the fusion of the phrenic and cervical sympathetic nerves in cats was followed by tachycardia, emaciation, irritability, increased sweating, elevated metabolism and in one case unilateral exophthalmos, lend great weight to the view that the sympathetic system plays at least an important rôle in the production of exophthalmic goiter.

But we are getting too far ahead. Let us leave the exophthalmic goiter subject for a moment and examine that which bears upon insufficiency of thyroid action. This perhaps may be said to start with Sir Astley Cooper,[12] who did thyroidectomies on two puppies in 1836 without, however, discovering anything of importance except that the animals could survive the operation. The observations made at the same time by T. W. King[12] of Guy's Hospital, however, are so enlightened as to justify quotation. Speaking of the thyroid he says: "Like all parts it requires to be nourished, but unlike some parts of the same class, its nourishment does not seem to be the main intention of its vascular supply." Again: "Whilst the nourishment of a part is indispensable to its existence, the influence which it exerts upon the circulatory fluids

may be more or less needful for the healthful subsistence of the entire animal," and finally: "We may one day be able to shew, that a particular material principle is slowly formed, and partially kept in reserve; and that this principle is also supplementary, when poured into the descending cava to important subsequent functions in the course of the circulation." It only requires slight paraphrasing to arrive at the modern conception that the gland incretes an autacoid, thyroxin, necessary to normal life, which is stored in the colloid and later delivered to the blood stream for general distribution.

In 1847 Dr. Hugh Norris[13] noted a high incidence of cretinism in a goiterous village in Somersetshire, and expressed the belief that this cretinism "is not only accompanied by but in some measure caused by the presence of goiter." Three years later (1850) T. B. Curling[14] performed autopsies on two sporadic cretins and could find no vestige of thyroid gland in either.

In 1871 Dr. C. Hilton Fagge,[15] another Guy's Hospital man, pointed out the identity of the symptoms and signs of endemic and sporadic cretinism, save for the presence of goiter in the former, and wasting or absence of thyroid in the latter. Fagge's discussion is distinctly penetrating. Observing that most cases of sporadic, like endemic cretinism, are congenital, he yet recognized that the condition might be acquired. In one of his cases it was apparently acquired at the age of eight, and in the light of this he was led "to speculate as to what characters would be present should the disease (if that be possible) arise still later in the course of adult life. The peculiarities in the form of the cranial and facial bones, and in the bony framework, generally, would then probably be absent, the development of the skeleton being unalterable when once completed." He concludes that the most marked features in such a case "would be a coarseness and thickness of the soft parts of the face (especially of the lips) and perhaps of the subcutaneous tissues of the hands and feet, besides the presence of the supraclavicular fatty tumours, and possibly a wasting of the thyroid body, if that should prove to be a constant character of the disease." In other words we have a first-class description of myxedema by a man who had never seen nor heard of a case.

The finding of actual cases by Sir William Gull[16] followed soon after (1874), as well as the demonstration by W. M. Ord[17] that they, like Curling's cretins, showed atrophied thyroids. Next came the more or less simultaneous discovery by Reverdin[18] (1882) and Kocher[19] (1883) that a like syndrome follows complete operative removal of the thyroid in human beings, or as Kocher called it, cachexia strumipriva. This led Felix Semon[20] (1883) of London to suspect the "existence of a common condition, probably a causative factor, in myxoedema, cachexia strumipriva and cretinism, viz. loss of function of the thyroid body." Thus we gradually have developed the clear appreciation of a group of symptoms directly due to thyroid lack, and alike in all essentials whether the thyroid be congenitally absent, destroyed or wasted by disease, or removed by the surgeon. Sir Victor Horsley's[21] production (1885) of a good imitation of myxedema by thyroidectomy in monkeys was a fitting culmination to this line of investigation.

Substitution therapy followed in short order. In 1890 Bettencourt and Serrano[22] report the relief of symptoms by the graft of half a sheep's thyroid under each breast. In 1891 Vassale[23] reported the prevention of cachexia strumipriva in dogs by the intravenous injection of an extract of their own thyroids. In the same year Murray[24] successfully treated a patient with myxedema by the subcutaneous injection of an extract of sheep's thyroid, and the year after two writers, Mackenzie[25] and Fox,[26] simultaneously reported good results from the administration of the gland by mouth. Both these last writers, it is interesting to note, describe what clearly were thyrotoxic symptoms when the dosage was too large.

Thus the recognition of a syndrome due to thyroid lack bore fruit, first, in the cure thereof by the giving of the gland, and second, the crowning achievement twenty years later, in the isolation of the active principle itself, the hormone or autacoid, thyroxin, by Kendall in 1915.[27]

We may return now to exophthalmic goiter. It is this type probably, since Marine[28] has shown how endemic goiter can be eradicated, and Plummer[29] how adenomatous goiter can be cured, that constitutes the most important goiter problem, or at least produces the greatest amount of controversy, at the present time. We left the subject with the neurogenic theory of the French school. The next step was Möbius'[30] conclusion (1884) that such a theory is inadequate. He was much impressed with two things, first that exophthalmic goiter in many of its symptoms and signs is the diametric opposite of the known hypothyroid syndrome, and second, that the operative removal of thyroid often materially relieves these symptoms. He concluded therefore that the basic cause of exophthalmic goiter rests upon a pathological alteration in the activity of the thyroid, although he admits that persons with neuropathic natures seem more disposed to the disease. After Möbius we have in 1893 a masterly paper by Friedrich Müller[31] who comes to similar conclusions. Müller, from the pathological point of view, in a series of autopsies, noted the absence of any constant type of nervous system lesion, and also noted the hyperplastic high columnar epithelium of the thyroid. He was also much impressed with the paradox of a loss of weight combined with increased appetite which these patients often show, and inferred that there must be an acceleration of catabolism. In one of his patients he demonstrated an increased rate of nitrogen metabolism. That the thyroid was importantly at fault Müller clearly believed, but he also felt that the nervous phenomena are too impressive for explanation on other grounds than the assumption of organic central nervous system disease. He therefore concluded that both a neurogenic and thyrogenic factor are necessary for the production of the syndrome. The neurogenic factor, however, he believed to be more closely of the nature of a toxin affecting the nervous system widely, as do lead, alcohol or iodine, than any focal lesion.

Müller's deductions about metabolism were abundantly confirmed by Magnus-Levy[32] whose studies of gas exchange soon showed a physiological antithesis between myxedema and exophthalmic goiter in a characteristic drop in energy metabolism in the former and rise in the latter. Finally, within the last year J. C. Aub[33] at the Massachusetts General Hospital has shown that a similar relation holds true in certain inorganic salt metabolism, that of calcium and phosphorus, both of which show an exchange increase above normal in toxic goiter and a decrease in myxedema.

In view of all this evidence it seems strange that anyone should seriously doubt that an exaggerated action on the part of the thyroid gland plays some important rôle in the production of the syndrome called exophthalmic goiter, and yet that is precisely what C. F. Hoover[34] has done within a month; nay more, he even suggests that in Graves' disease we actually have hypothyroidism! Hoover's philosophy apparently is based upon the fact that Marine found some years ago in goiterous animals an histological picture much like that seen in human Graves' disease, and also in the fact that the goiters found in myxedema and those in Graves' disease may both become smaller under the administration of iodine. This is hardly sufficient to overthrow the hyperthyroid theory of toxic goiter. In the first place, goiter is no essential part of either myxedema or cretinism, and the finding of hyperplasia in certain cretins, instead of proving that such an histological picture of necessity denotes hypofunction, might as well be taken to mean that in these particular cretins there was an attempt at hyperfunction. It might be pertinent to point

out that Uhlenhuth[35] finds a picture similar to Marine's cretins and to human exophthalmic goiter in salamanders at the time of their metamorphosis. He has further shown that thyroidectomized salamander larvae will not metamorphose, but if fed thyroid they will. It is hard to reconcile these facts with any theory other than that at the time of the metamorphosis there is a call for increased thyroid function. I conceive that the hyperplasia in Marine's cretins is due to an attempt on the part of the gland to manufacture thyroxin while lacking a necessary ingredient. This might well lead to hyperplasia, but since the attempt to produce thyroxin is futile, the symptomatology is that of hypothyroidism. In exophthalmic goiter, as Plummer supposes, there may be an intense stimulus or drive upon the thyroid which whips it to overaction and consequently leads to hyperplasia. In this instance thyroxin is produced and the symptoms in part at least are those of an excess in the body of that substance.

Hoover, I believe, has confused the problem because his observations have been made in a highly goiterous district. There is no question but that the natural history of both exophthalmic goiter and myxedema is different in goiterous and non-goiterous regions; in the former the picture is complicated by the added factor of endemic goiter.

I can agree with Hoover that the original cause of exophthalmic goiter is unknown, but I cannot agree that the thyroid is underactive instead of overactive. If his hypothesis is correct, thyroxin should relieve exophthalmic goiter as it does myxedema, but assuredly our experience is that it does not.

The solution, I believe, will most probably come through the experimental production of the disease. Cannon so far as I am aware is the only one who has been at all successful in this direction. His work, although never successfully repeated, since, as Sharpey-Schafer points out, the results were positive, stands as the one bright spot in the search for the primary cause. It at least shows that a stimulus reaching the thyroid through the vegetative nervous system can give symptoms identical with those produced through thyroid feeding, together with the exophthalmos which cannot so be produced. Whether the thyroid under these circumstances is driven to produce an excess of normal or abnormal thyroxin, who can say? Theoretically it might do either or both, and the work of Cannon therefore, so far as we can determine now, is compatible with the theory of Plummer that in exophthalmic goiter we have not only a hyperthyroidism but a dysthyroidism as well.

As clinicians our aim is to cure our patients. With respect to Graves' disease we must use the best agent we have. Ultimately we shall somehow remove the cause; at present the best we can do is to remove a large portion of the organ responsible for the bulk of the symptoms. Crude as this procedure is from the physiological standpoint, the results, thanks to the remarkable adjusting capacity of the organism, are extraordinarily good.

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REVIEW OF 4000 ANESTHESIAS IN THYROID SURGERY*

ALVIN F. RENNEKER, M.D.

DeCourcy Clinic

CINCINNATI

THE extension of laboratory examinations and more thorough physical examinations made before operation are a great step toward the individualization of treatment. They represent a movement in the right direction which needs to be still further developed in the best interests of surgery and the patient. We cannot know too much of his physical condition. It furnishes the necessary basis for interpreting the reactions observed during and after operations and renders surgical intervention safer and more definite. The surgical team is rapidly coming to be made up of a group of cooperating specialists whose members are prepared to apply the discoveries of the various medical sciences to the patient at operation.

The surgeon in particular needs to encourage and develop his associates so that they may better perform important functions that he is unable to carry out himself during the operation. The only way to develop the anesthetist into an internist with a surgical "slant" is to increase his responsibilities and to demand more definite answers to the common question: "What is the patient's condition?" Laboratory work and physical examinations lose much of their force if similar and accurate observations are not followed throughout the operation.

Not infrequently circulatory reactions begin on the table, which if neglected when they might be corrected, lead to the death of the patient and to the discredit of surgery. The circulation is a delicately balanced mechanism that reflects the immediate condition of the patient in a most exact manner. A continued study of its reactions soon convinces the observer of the truth of this statement. The variety of responses is large and it requires experience and study to interpret them; nevertheless every anesthetist should master what seems to me to be one of his most important duties.

To make the work practical and of immediate as well as of later educational value, a graphic record of the pulse rate, the systolic and diastolic blood pressures, and the respiration, and notes regarding the patient should be made during the operation at frequent intervals. Fortunately these observations and records may be made by the anesthetist without much inconvenience. With this information the anesthetist will learn more of the direct effects of his technique and what anesthetics are best. The surgeon also will learn by a review of these records that certain methods of operating under certain conditions are good or bad. In the end, both are benefited, as is also the patient.

In an observation and study of the various anesthetics we have used in a series of 4000 goiter cases extending over a period of ten years, we have observed the following:

LOCAL ANESTHESIA

The first five hundred odd cases were all done under local anesthesia, a solution of ½ of 1 per cent novocaine with 8 drops of adrenalin to the ounce being used, with no limit as to the amount of solution used to do the work in a satisfactory manner. The incision of the skin, the cutting of the muscles, the division of the capsule were all accomplished in a satisfactory manner, the drawback to the local technique being that when the gland was elevated from its

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bed and the capsule stripped back, all patients complained of an uncomfortable feeling, a feeling of being strangled, and during this part of the operation they usually became panicky. Those that objected to a local technique at that time were given open drop ether, with its excitement stage, its deep narcosis, its disagreeable nausea and vomiting in the stage of recovery, and its penetrating effect on the operator and his assistants. After completing this series of between five hundred and six hundred cases under local anesthesia, we began to realize that this local technique, while spectacular to the spectators, was seldom appreciated by the patient. Although many times no pain was felt, the physical shock was always bad, the wear and tear on the operator were great and the time consumed was usually twice as long as under general anesthesia.

NITROUS OXIDE AND ETHER

Local infiltration and nitrous oxide gas induction with a light ether sequence were now in order. This technique was found very satisfactory for quite a long time, the induction was rapid, the amount of ether used was small, the patient usually left the operating table conscious, and the stage of recovery was seldom more stormy than under local anesthesia.

NITROUS OXIDE OXYGEN ANESTHESIA

About five years ago we started using nitrous oxide oxygen anesthesia in all our goiter cases. Its advantages are many: The induction is rapidly accomplished, the patient does not dread the anesthetic, recovery is very prompt, dosage can quickly be regulated to fit the individual patient, the field of operation remains very quiet making it advantageous for the surgeon to do good work, and nerve injury can be easily detected by the change in the respiratory rate and the crowing inspiration that sets in under the light anesthetic. There is no trouble with an excess of mucus, and enough rigidity is always present to keep the tongue from falling back and obstructing respiration. If during the course of the gas-oxygen anesthesia the manipulations become unusually rough, it takes but a moment to deepen the anesthetic; if the patient temporarily refuses to breathe, 100 per cent oxygen can be given by direct pressure and the patient brought back to a safe level. Recovery is of course very rapid, the patient becoming conscious before leaving the table. The vomiting and retching is reduced to a minimum, making the danger of postoperative hemorrhage almost nil.

Ethylene we have tried and discarded. We saw no advantage over gas and oxygen, but our chief objection was its odor. Everyone connected with our team had a headache from it that persisted all day. The bleeding from the superficial structure of the neck was aggravated in all our cases, due we believe to the excess of oxygen present in the mixture. Cases that showed a tendency to vomit did not recover as promptly from this as they did under straight gas and oxygen, one case in our series vomiting incessantly for three days.

Good judgment in the choice of an anesthetic should be exercised and if the surgeon or anesthetist finds himself confronted with a situation wherein a given agent or agents do not produce the desired effect, the use of other agents should be resorted to unhesitatingly in order that a well-balanced anesthesia may be produced with as little untoward reaction as possible prior to, during and after the operation. The anesthetist should be skilled in using both local and general anesthesia and should not hesitate to give up one type and turn to another as occasion demands. I believe that every goiter operation is facilitated by the use of a gas and oxygen anesthetic properly administered.

The thing the patient appreciates most in being given this anesthetic is to be "blown asleep." Never hold the mask down on the face while inducting the anesthetic; for this point I have to acknowledge my indebtedness to members of the dental profession. They blow the gas into the patient and the latter does not experience

that choking sensation so common when the face mask is held firmly on the face when beginning the anesthetic.

During this anesthesia the anesthetist should attempt to keep the patient asleep and his color natural, as pink as possible, whether he is soundly asleep or not. A vicious cycle is easily established by continued cyanosis, wherein respiration becomes insufficient, the blood becomes blue or black and the pulse becomes weaker and weaker because of the progressive decrease in the available oxygen. Lack of oxygen depresses the circulation, and deficient circulation diminishes oxidation. Ultimately the point is reached where circulation is insufficient to aerate the tissues even when pure oxygen is administered. When general anesthesia is superimposed on the foundation provided by preliminary hypnotics and local anesthetics, it should not be carried to the point where the patient's natural color changes.

CIRCULATORY DISTURBANCES

About 70 per cent of all goiter cases presenting themselves for operation come in because of urgent symptoms referable to the circulation or respiration. Cardiac arrhythmias are present in many cases. Practically all thyroid cases have a tendency to cyanosis and respiratory obstruction during some part of the operation. This may be due to the size or position of the gland or to the strained position of the shoulders on the sand bag, throwing the head too far back; obstruction in the mouth or throat must always be thought of. The anesthetist should know the circulatory conditions of the patient at all times.

The pulse and blood-pressure ratios and reactions are prerequisite for the interpretation of the circulation. Cardiac arrhythmias affecting the rate are readily detected in the pulse. The functional types often disappear during a carefully conducted narcosis. The circulation in these cases is usually good, but sometimes improves. The organic types either do not improve or are made worse.

Pulsus alternans, which is an arrhythmia not necessarily of rate but of weak and strong heart contractions characterized by alternating small and large pulse pressures, is not only readily detected with the sphygmomanometer but is subject to actual measurement. Arrhythmias, particularly of this type, require close watching because a serious impairment of the muscular organisms of the heart, which has lost the capacity to respond with maximum contraction to every stimulus; the contracting capacity is diminished. Pulsus alternans is second in frequency of the cardiac arrhythmias and of particular importance in surgery of the thyroid as indicating myocardial defects.

The patient may show no arrhythmia before operation but under the stress of surgery, pulsus alternans occasionally develops, showing that the heart muscle is unable to respond adequately to the extra labor. It is encountered more frequently in hypertension, arteriosclerosis, myocarditis and nephritis. These cases promptly succumb to a fall in blood pressures and increased pulse rate.

If the condition is recognized before operation, digitalis is indicated even though the pulse rate is not rapid. When it develops during operation, some digitalis preparation should be administered intravenously. The operation should proceed with the minimum of trauma under the lightest possible narcosis. Morphine in sufficient dosage to produce its physiological effects is desirable, preferably before operation. It may also be used with good results during the thyroidectomy.

Myocardial defects are more serious than compensated valvular disease of the heart. The crux of the matter is whether or not the circulatory mechanism is able to maintain a proper distribution of blood without cardiac exhaustion during the relatively short period of surgical intervention. A study of the case at the moment will show how far we may go with a thyroidectomy. If the case is borderline before beginning the operation, the test of surgery

only will tell how the circulation may react. Patients with valvular defects which are grossly complicated with myocardial weakness require most careful anesthesia and surgery to avoid disaster. All valvular cases may be regarded with suspicion until the test of surgery shows the heart muscle to contain the essential reserve power to compensate for any ordinary disturbance of blood distribution.

SUMMARY OF CASES

In the ten years that we have been performing thyroidectomies we have dealt with every conceivable type of patient from a patient aged seventy-one to a child of eleven years. Every type of goiter has been attacked, including six previously diagnosed malignant glands. We have frequently ligated the superior thyroid artery, and for a time favored ligation of the inferior thyroid artery. Lobectomy has been practiced in some very severe cases, with the removal of the remaining lobe on the following day.

In these thousands of cases I have seen but one death upon the table and that from an injury to the jugular vein which was adherent to the thyroid capsule, death being due to an embolism. I have seen one case anesthetized three times in a period of two hours for hemorrhage, with no bad results. I have seen but two cases of nerve injury. I am not familiar with tracheal collapse, having seen no such cases.

CONCLUSIONS

Gas and oxygen with proper preliminary medication is the anesthetic of choice in thyroidectomy, although it is the most difficult to administer.

For the success of our cases, we must have a definite surgical team. The first assistant must know the operator's every move. The surgeon must have unbounded confidence in his assistants. He must consult his anesthetist as to the advisability of doing a complete or incomplete operation in one stage, whether or not it will be safe to close the neck after operation or whether it should be left open for twenty-four to thirty-six hours.

The anesthetist must be quick to recognize changes in the respiratory rate, the pulse rate, the color signs; he must know the condition of the heart before and during operation. He must warn the surgeon of any manipulations that are endangering the patient. When this team works together as a unit for the patient's welfare, we can then and then alone hope to be very successful in our thyroid cases.

TREATMENT IN ACUTE MECHANICAL INTESTINAL OBSTRUCTION*

HARRY B. EISBERG, M.D.

NEW YORK

IN a consideration of the treatment of acute intestinal obstruction one must bring to the fore the salient fact that at present the death-rate in the intermediary and late cases of this condition ranges from 30 per cent to 60 per cent, whereas with early diagnosis and operation the mortality compares favorably with that of other acute surgical conditions.

There are two main reasons for this. The first rests with the laity and is, at present, excusable, for their understanding of intestinal cramps, vomiting and constipation is not that of an intestinal obstruction, and therefore immediate medical aid is not always sought. The significance of the given symptoms will not be appreciated by the public until this is brought forcibly to its attention. The second reason rests with the physician, who should ever be alert in the interpretation of these symptoms and their grave import.

In this connection Deaver[1] states: "Why is the present death-rate 50 per cent instead of 10 per cent? The answer is: early diagnosis has not been made. And why has an early diagnosis not been made? Because the naked abdomen has not been carefully scrutinized and carefully auscultated and palpated, including examination per rectum and per vaginam."

The course of treatment outlined in this paper is based upon 137 cases admitted to Harlem Hospital, and upon animal experimentation. No discussion will be made of experimental investigation into the nature of the toxemia; only that part of the experimental problem will be alluded to which has a distinct bearing on the clinical treatment and has therein proved of value.

In a previous communication[2] clinical mechanical intestinal obstruction was divided into two types (Figs. 1 and 2), based on animal experimentation. Wilkie,[3] in his observations upon appendicitis, calls attention to the acute appendicitis and the acute appendicular obstruction. The latter corresponds to Type 2, segmental intestinal obstruction.

Type 1 and Type 2 clinical mechanical obstruction can be further classified as early, intermediate and late. This classification has no reference to units of time alone. The terms used are based on a consideration of the type of obstruction, the location in reference to the duodenum, the number of hours the obstruction has existed and, in Type 2, the size of the involved loop or segment and the condition of the circulation. All these factors must be considered together.[4] To illustrate: a simple Type 1 obstruction at the rectum is early a week after onset, whereas a similar obstruction at the jejunum within twenty-four to forty-eight hours becomes late. A Type 2 obstruction, volvulus of the sigmoid, is early only for several hours after onset, and is late within twenty-four to forty-eight hours, while a Type 1 obstruction of the sigmoid would be early for days after the onset. Usually the obstruction cannot be clinically classified before operation, therefore a prognosis should always be guarded until celiotomy has established the above factors.

Experimentally, the treatment is very

* From the Surgical Service, Harlem Hospital, and the Department of Experimental Surgery, New York University and Bellevue Hospital Medical College, New York. Read before the Harlem Medical Society, December 1, 1926.

definite, and a detailed plan can be outlined in each animal, depending upon the type and duration of the obstruction. In simple or Type 1 obstruction and segmental or Type 2 obstruction, before a severe toxemia exists, removal of the obstructing agent and reestablishment of the continuity of the canal, is all that is required, regardless of the location of the obstruction. There is no mortality in either instance as the result of the obstruction.

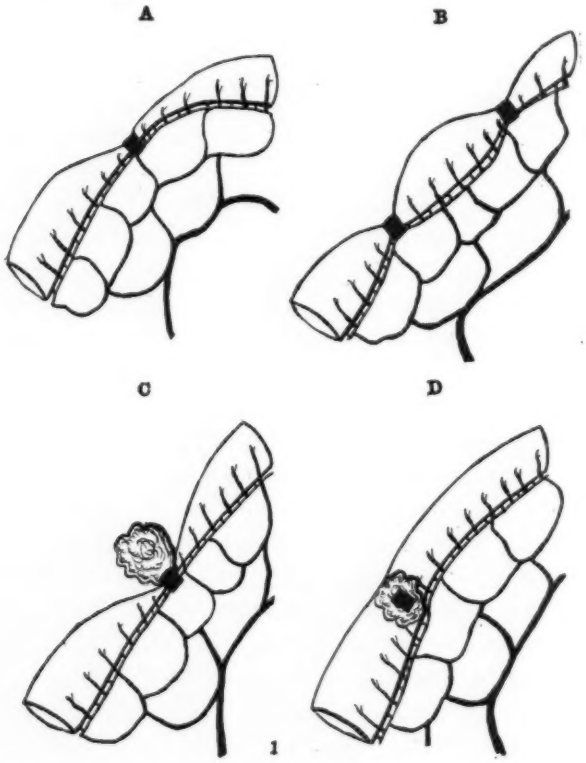

Fig. 1. Type 1 obstructions (diagrammatic): A. Occlusion by bands or adhesions; B. Double occlusion by bands or adhesions; C. Occlusion by pressure of tumor from without; D. Occlusion by tumor within the intestinal canal. There is no interference with the mesenteric circulation in this type of case. The black oblong indicates the site of occlusion of the canal.

In the intermediate case of obstruction, if both types are treated in the same way as described above, the mortality becomes positive, but by far the large majority of animals recover. If the same treatment is carried out in the late cases, where a severe toxemia exists, death is inevitable in both types. Since there is a slight mortality in the intermediate cases and a 100 per cent mortality in the late cases, an additional technical procedure may be considered, and for this an enterostomy can be utilized. Experimentally, it is not successful.

If the contents of the duodenum and oral jejunum are permitted to escape externally, in normal animals, death occurs within the same number of hours as when there is an obstruction at these points. To be compatible with life jejunal drainage must be at least 60 cm. from the duodenojejunal ligament. In the low ileum and colon, enterostomy and colostomy do not produce any marked deleterious effects on the animal.[5]

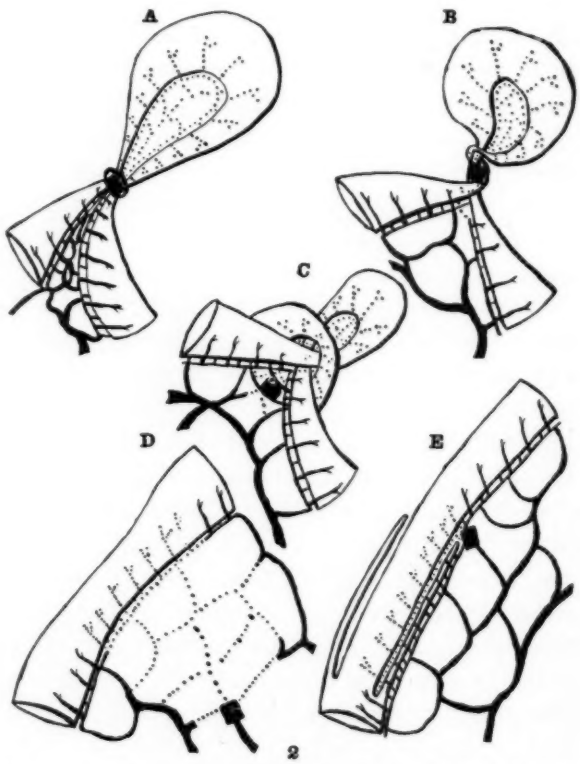

Fig. 2. Type 2 obstructions (diagrammatic): A. Loop; B. Volvolus; C. Knotted bowel (double occlusion of canal with interference in the mesenteric circulation); D. Mesenteric thrombosis; E. Intussusception (here the block of the circulation acts practically as an occlusion of the lumen of the canal). The black oblong indicates the interference in the mesenteric circulation and occlusion of the canal in A, B, C, and interference with the mesenteric circulation only in D, E. Dotted lines indicate absence of circulation.

In later observations[6] made upon high duodenal and high jejunal obstructions that were drained twenty-four hours after

the obstructions, the animals died sooner than those with obstructions alone or fistulae alone. The coincident toxemia was more grave. The results of the experiments of Orr and Haden[7] are similar, and they showed, in addition, that the findings in the blood in these cases of fistulae are similar to those in high obstruction. In their conclusions they state: "With the well-known danger of duodenal fistula and the rapid death of animals following experimental jejunostomy in mind, we believe that the clinical value of jejunal drainage for obstruction of the small intestine is yet to be proved."

The employment of jejunostomy is contraindicated in both types of obstruction, regardless of whether the case is early, intermediate or late. After the obstructing agent is removed, a toxemia still exists, and why intestinal drainage is of value must necessarily be questioned. Lower down in the intestine, where the enterostomy itself is not fatal, the beneficial results obtained can be explained by the fact that the reconstruction operation was omitted, which in itself adds more shock to an already prostrated animal. Here, however, an enterostomy or colostomy is of no value if the toxemia has already advanced far. One must not lose sight of the fact that if the animal should recover, there still remains the repair of the fecal fistula, which has a hazard of its own.

A closed intestinal tract at the end of the operation in either type of obstruction after removal of the causative agent is desirable. However, this is not always feasible and a partial or divided operation may be resorted to in very toxic animals. Here the gangrenous loop is placed upon the abdomen without resection and oral enteric drainage. This is a rational procedure, for a gangrenous loop of gut if placed outside of the abdominal cavity in itself produces no ill-effects upon the animal. An uneventful recovery results if the continuity of the canal be reestablished.

The administration of large quantities of fluids under the skin and into the veins is more reliable than when given through the jejunal catheter or enterostomy.

Connors and others[8] have definitely shown the presence of an acidosis as indicated by changes in the carbon dioxide combining power, and where there is an accumulation of the nitrogenous waste products, they follow the order of retention presumably characteristic of renal impairment. Haden and Orr[9] have shown a fall of the blood chlorides and have administered a physiological solution of sodium chloride with beneficial results. McQuarrie and Whipple[10] have demonstrated an impaired kidney function. Zeman and others[11] and Brown and others[12] have demonstrated definite kidney changes, both clinically and experimentally.

The free administration of water by the various methods undoubtedly prolongs the life of the obstructed animal, as shown by Hartwell and Hoguet,[13] and Draper,[14] hence fluids should always be forced to the maximum, not only as a diluent of the toxin or toxins, but also because of impaired kidney function.

This brief résumé of the experimental side of the problem has been emphasized because of its direct application to the clinical case.

All cases of suspected or positively diagnosed obstruction, when admitted to the hospital, should be considered urgent. Although operation is the most important consideration in the treatment of obstruction, many cases have been lost through the lack of proper preoperative and postoperative care. The longer the obstruction has existed, the more important is the diligent care of these patients.

An enema is given as soon as possible. One must not be misled by a return of feces, for this may be the remains of the fecal contents below the obstruction. Many cases have been held over for several hours before operation was decided upon, owing to the results of this enema and the temporary relief it very often affords. Another enema should be given in an hour or sooner if the diagnosis is not positive. Gastric

lavage is indicated in all intermediate and late cases, and should be used diagnostically in questionable cases, where it is often repeated. In those cases in which the toxemia predominates, saline solution should be given by hypodermatoclysis or infusion before operation.

Specimens of blood for chemical analysis, and of urine for routine examination, and especially for indican and phenol, are sent to the laboratory. These examinations should be made every few hours, for they are of great value in establishing a diagnosis in questionable cases, and if specimens are taken repeatedly, preoperatively and postoperatively, they are of considerable aid in determining the prognosis or indicating the necessity of a secondary operation.

A general anesthetic may be employed in all early cases. In late cases, local anesthesia is the one of choice. If extensive exploration is required, general narcosis is usually added, because a rapid thorough exploration of the abdomen with distended gut is almost impossible under local anesthesia. All cases should receive a gastric lavage just before operation, because, in several instances, death has been caused by aspiration of the vomitus. In those cases in which the toxemia predominates it is preferable to operate upon the patient in bed, as the moving from bed to stretcher, to operating table, back to stretcher, and then to bed, materially exhausts an already prostrated patient.

After several hours of careful clinical study and medical treatment, all doubtful cases with a history of intermittent or constant cramp-like abdominal pains, vomiting and obstipation, should be subjected to a rapid exploratory celiotomy. This constitutes good surgical judgment, as the operation entails no additional risk. When one procrastinates, and the case proves to be an intestinal obstruction, the coincident toxemia may prove fatal, despite the surgical interference. The exploratory operation has, time and again, been strongly advocated by many surgeons.

In those cases where a positive diagnosis of obstruction is made, operation is to be performed as soon as possible. The speed of the operation must be considered. In the majority of surgical conditions speed is not paramount, but here it is of the utmost importance, especially if the patient is subjected to a general anesthetic.

Upon opening the abdomen, the presence or absence of fluid is of aid in determining the correct operative procedure. A small amount of serous fluid is occasionally present in Type 1 or simple obstruction, but it occurs late and is probably the result of intra-enteric pressure above the obstruction. If it is not present in segmental or loop obstruction, Type 2, its absence signifies either that the operation was performed early, before definite circulatory changes occurred, or that there was no obstruction of the mesenteric circulation, as in a two-band simple or Type 1 (Fig. 1, B) obstruction. The fluid and its character, if present, designate various degrees of devitalization. Serous fluid indicates that the gut is viable and that the circulation will return. Serosanguineous fluid occurring early, based on the history of the case, indicates that the gut is viable; later the question of resection must be considered, although the gut may be returned to the peritoneal cavity, and a return of the circulation may occur. Sanguineous fluid makes resection almost imperative. Sanguinopurulent fluid indicates one thing, gangrene, in which there is no hope for the return of the circulation.

In early cases of Type 1 and 2, all that is required is the removal of the obstructing agent. No mortality occurs as the result of the obstruction, as there is little or no toxemia.

In the intermediary and late cases, in Type 1, the seriousness of the obstruction depends upon its proximity to the duodenum and the number of hours it has lasted. In addition to the removal of the obstructing agent, an enterostomy may be considered. The value of this procedure is referred to later.

In the intermediate cases in Type 2, resection must be considered. The all-important factor is the questionable viability of the presenting loop, which the surgeon must judge. If there is any doubt, resection is indicated. In some instances the circulation in the involved segment or loop has apparently returned sufficiently to warrant its replacement into the peritoneal cavity. On the other hand, where the return circulation is sluggish, great care must be exercised before the segment is considered viable. For the gut to be sufficiently viable to obviate a resection, there must be a rapid return of the circulation, as manifested by color and luster, after the obstructing agent has been removed. Although the segment may be edematous, there should be no line of demarcation of color. On palpation, the pulsation of the mesenteric arteries is essential, as well as the pulsation of the terminal arches, and the vasa-recta at the mesenteric border of the intestine. Special attention should be paid to those vessels located in the central portion of the involved segment; if there are marked arterial changes, resection becomes almost a necessity. The size of the involved segment must also be taken into consideration.[15] If resection is decided upon it should be performed with immediate reconstruction of the canal.

If, for any reason, the patient is considered a poor surgical risk, the questionable segment can be delivered upon the abdomen and a tube inserted in the normal oral gut. In this instance, the segment is later resected. Reconstruction of the bowel at the time of resection depends upon the condition of the patient and the proximity of the involved gut to the duodenum. After the decision is made to leave the segment upon the abdomen, it is not done with the idea that the circulation will return to it.

When the viability of the gut is at all questionable, allowing it to remain in the peritoneal cavity, with the idea that it is just as safe to resect within twenty-four hours or more, is to be condemned, for the reason that within these twenty-four hours, if the circulation does not return to the segment, a fatal toxemia may result despite a secondary operation. Although it has been shown that the circulation did return in some instances, on the other hand in numerous instances it did not return, as proved by autopsy.[4]

In the late cases of Type 2, when gangrenous gut is present, resection is indicated; if the patient's general condition is poor, the involved segment is placed upon the abdomen with a tube in the normal oral gut, as in the intermediate cases with complications, just described. From personal observations and those cited in the literature, this type of case terminates fatally in the large majority of instances, regardless of the operative procedure, as the result of the toxemia.

When there is gangrenous gut or gut of questionable viability which may become gangrenous, even if the patient is in a serious condition, it should be removed from the peritoneal cavity. To grasp the first presenting piece of intestine and perform a jejunostomy or enterostomy alone is not a good surgical procedure, because a toxic absorption occurs from these affected segments or loops and produces a fatal toxemia despite simple enteric drainage.

Jejunostomy and enterostomy in any type of obstruction have not proved satisfactory procedures in this series of cases. However, many favorable results have been reported. Surely in the early and intermediate cases it has no place outside of the exception mentioned above, in connection with complications in cases where the viability of the gut is questioned. In the late cases it has proved futile.

If peristalsis does not return, drainage by enterostomy is segmental only. If peristalsis is reestablished, the flow of feces does not stop at the enterostomy tube; part of the intestinal contents passes by the tube and is later expelled by the rectum. Therefore, enterostomy is of little or no value as a means of drainage. In numerous instances spontaneous closure

of the intestinal fistula does not occur and a secondary operation is required. The introduction of fluids through the enterostomy tube has not met with favorable results. Fluids in large quantities, which are so essential in the treatment of this disease, can be given more efficaciously under the skin or into the veins. Many times a fatality results before the closure is attempted. When employed in markedly distended gut, as in paralytic ileus, it acts only as a segmental drainage, that is, only a very small part of the bowel is really drained. The resultant decrease in intra-enteric pressure may bring about a return of peristalsis, but the same effect can be obtained by gastric lavage, enema and medication. Enterotomy, on the other hand, may drain the bowel sufficiently to reduce the intra-enteric pressure and likewise stimulate peristalsis. The advantage with this method is that no secondary repair is required. If a jejunostomy or enterostomy is decided upon, the technique of McKenna[16] for the former and that of Mayo[17] for the latter are very satisfactory.

The removal of the toxic material from the intestine is of negative value, because, when an enterostomy is really indicated, an overwhelming blood intoxication is present. Furthermore, high drainage adds to the starvation and dehydration of the patient. From all the evidence gathered, the closed intestinal tract offers the best results, if it is feasible.

The various operative procedures in fatal cases can be criticised on two grounds: either too much or too little is done. Those cases in which too much is done are the cases that are very toxic and in which the resection of gut is performed with an immediate reconstruction operation and an enterostomy. Here no time must be lost in determining what to do, as time is one of the most important factors. One must enter the abdomen quickly and get out quickly; in extreme cases all that is required is to deliver the devitalized segment upon the abdomen and introduce a tube through the normal oral end. When numerous bands and adhesions are present, without circulatory changes in severe toxemias, one must determine as rapidly as possible which is the obstructing band and release it. We must not attempt to remove all other adhesions. We must avoid too careful toilet of the raw surfaces in these extreme cases.

Too little is done in cases where all of the actual obstructing bands have not been removed. Allowing the questionable gut to be returned to the peritoneal cavity with the idea of reoperating in twenty-four hours if the patient does not do well, is to be condemned on the ground that if the circulation does not return, this twenty-four hour interval is sufficient to produce a fatal toxemia. Certainly, too little is done where the first presenting loop of intestine has been grasped and a tube is inserted, and no attempt is made to ascertain the type of obstruction.

One of the most difficult decisions to be made, after a primary operation for obstruction has been performed, is when to reopen the abdomen. The indications for reoperation are the symptoms and signs of another obstruction, or evidence that the first operation was not complete. Obstruction, on the other hand, may follow operations of any sort, such as that due to a loop of gut caught in a uterine suspension operation, or an inflammatory band following the removal of a ruptured appendix. Again, a postoperative paralytic ileus may occur in any instance, without a mechanical obstruction. Here, time and again, the ingenuity and diagnostic acumen of the surgeon are severely taxed. The solution of the problem is: when in doubt, operate.

The postoperative treatment of intestinal obstruction is extremely important, and it begins as soon as the patient leaves the operating table. Twenty-four to forty-eight hours after the operation is entirely too late for the inception of postoperative therapeusis.

Dilution of the toxin or toxins, and elimination through an impaired kidney

and intestine are the only means of coping with the toxemia. This dilution and elimination are secured by the copious administration of saline solution by hypodermatoclysis and by infusion and, if possible, of fluids by mouth and rectum. For the concomitant acidosis, glucose solutions are administered subcutaneously and intravenously.

Removal by phlebotomy of sixteen to eighteen ounces of blood and its immediate replacement by fluid are indicated in late cases. Resort early to stimulation with pituitrin. Gastric lavage and high colonic irrigations are to be practiced early and frequently, unless a reconstruction operation has been performed. After gastric lavage, 2 ounces of hot magnesium sulphate solution, or 1 ounce of castor oil should be placed in the stomach as soon as the patient recovers from the anesthesia. However, with resection and reconstruction of the intestine, if the indication arises, gastric lavage and enemas can be administered with safety after a lapse of twenty-four hours.

ANALYSIS OF CASES

Forty-one personally operated cases have been studied. There were 13 cases of occlusion of the lumen of the canal (Type 1), 11 of which were the result of bands and adhesions, the remaining 2 due to carcinoma. Twenty-six cases were of Type 2 and showed, in addition to the occlusion of the lumen of the canal, interference with the mesenteric circulation. Of these cases there were 9 femoral hernias, 5 inguinal hernias, 1 ventral hernia, 1 umbilical hernia, 1 volvulus of the sigmoid, 1 intussusception, 8 loops of bowel caught by bands and adhesions. The remaining 2 cases were diagnosed as mechanical obstructions, but proved to be instances of paralytic ileus.

The following operative procedures were carried out in these cases: In the 13 Type 1 cases, bands and adhesions were cut in 11 cases, without other operative procedures. In the 2 remaining cases of carcinoma, the tumor was placed upon the abdomen with enteric drainage, immediate in one, subsequent in the other; resection of the tumor was performed a few days later; in one of these cases a subsequent reconstruction operation was performed, the second died before this could be attempted.

Of the 26 cases of Type 2 obstruction, the cutting of a constricting hernial ring was performed in 16 cases. In the 8 cases where loops of gut were caught between bands or adhesions, the constricting bands were cut. In 4 of these cases the following additional procedures were carried out: In 1 case a resection, with immediate reconstruction of the canal; in 2 cases resection with oral drainage, without immediate reconstruction; in the remaining case the gangrenous loop was left upon the abdomen with oral drainage. The last 3 cases died before a reconstruction operation was possible. In the case of intussusception it was manually reduced. In the volvulus case the loop was placed upon the abdomen with oral enteric drainage; later the loop was resected and, several months after, reconstruction of the canal was performed. In the 2 cases of mistaken diagnosis (paralytic ileus) cecostomy was done upon one and enterotomy on the other; the former required a secondary operation for closure of the fecal fistula.

There were 12 deaths in this series. Of the 13 cases in Type 1, there were 4 deaths, 2 early, 1 intermediate and 1 late. The first developed an uncontrollable diarrhea, and the patient died three weeks after operation. The second case was one of carcinoma of the large intestine and the patient died three weeks after operation, before closure of the colostomy. The third was one of carcinoma of the ascending colon, and died of cachexia four weeks after operation. The fourth case had an associated pelvic abscess, and death resulted from a generalized peritonitis, seven days after operation. In these 4 cases, in no instance was the death directly due to the obstruction toxemia.

Of the 26 cases of Type 2, there were no deaths in the early cases; in the intermediate class, 2 deaths occurred. The first was that of an intussusception, in which the involved segment, of questionable viability, was allowed to remain in the peritoneal cavity. The patient developed a postoperative bronchopneumonia. At autopsy, the segment was found to be devitalized. In the second case a loop of gut caught between two bands was released, and although of questionable viability, a resection was done and a jejunostomy performed. The patient died five days after operation, with evidence of an obstruction toxemia. There were 6 deaths in the late cases. The first was a strangulated hernia; the patient suddenly died on the fifth day after making an apparently uneventful recovery. A patient who had volvulus of the sigmoid died six months after the primary operation, with a general peritonitis due to leakage at the site of the reconstruction operation at this time. The remaining 4 cases all died as the result of the obstruction toxemia.

I am indebted to Dr. J. F. Connors, Surgical Director, Harlem Hospital, for the opportunity to study clinical intestinal obstruction during the past nine years.

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THE SECONDARY RÔLE PLAYED BY MICROORGANISMS IN THE CAUSATION OF INFLAMMATORY CONDITIONS OF THE DIGESTIVE ORGANS

A. L. SORESI, M.D.

Visiting Surgeon, Greenpoint Hospital, Brooklyn

NEW YORK

THE infectious nature of the pathogenesis of the so-called inflammatory conditions of the digestive organs, such as gastric and duodenal ulcers, cholecystitis and cholelithiasis, pancreatitis, chronic and acute appendicitis, etc., is accepted by the medical profession. I aim to demonstrate that the infectious theory is wrong, because microorganisms play only a secondary rôle, while the primary causes (as to time and importance) are malformation and malposition of the immediately affected or neighboring organs, existent before microorganisms could affect them.

By malposition and malformation I mean conditions that differ from the normal, not stating, however, that in every case where these abnormal conditions are present gross pathological change must follow.

Malformation and malposition may occur in any portion of the gastrointestinal tract, but whereas in some parts they might cause little or no disturbances, in others they cause slow or rapid damage. Practically all the pathological changes in the digestive organs are observed at three points: first in the right upper abdominal quadrant, which includes the pylorus, first and second portion of the duodenum, portal vein, hepatic artery, hepatic, cystic and common ducts, gall bladder and adjacent portions of the liver, the pancreas, the lesser omentum; second, in the region of the cecum, including the appendix and the ileocecal valve; third, at the sigmoid.

The malformations and malpositions to be studied are the following: In the first region the lesser omentum and a portion of the transverse mesocolon become fused together, during fetal life. In the second region appendices become kinked with short mesentery or are misplaced during fetal life. In the third region the descending colon, the sigmoid especially, is greatly distended, dilated and elongated. We may add that other portions of the gastrointestinal tract may become distended, elongated and adherent. I shall not here discuss such abnormalities as Jackson's membranes, Harris' band, Lane's kinks, etc., nor faulty rotation of the colon, which, however, are obviously included in the terms malformations or malpositions.

My study of still-born infants leads one to believe that the main factors causing the malformations and malpositions mentioned above are: (1) the presence of meconium in the colon; (2) the position of the fetus in utero. These two factors cause the formation of those adhesions, kinks and deformations of the digestive organs that are observed later at operation or autopsy and that are attributed to infectious processes. The infectious processes are a factor in the causation of the lesions observed later in life only because of the faulty anatomical structure, which favors stasis and stagnation and consequent growth of microorganisms and their infiltration in the tissues. Microorganisms would very seldom cause any pathological change in the digestive organs if the faulty anatomical structure was not present. To illustrate and make plainer this assertion we may compare a normal mouth to a normal digestive system and a cleft palate to an anatomically faulty digestive system. Microorganisms are present in all, but

whereas in the normal mouth their presence is harmless, in cleft palate they do cause local and general lesions. Would anyone state that the presence of microorganisms in a mouth anatomically faulty, as in cleft palate, is the primary cause of the local and general pathological processes observed in cleft cases? Obviously the primary cause is the faulty construction of the mouth. The same must be stated of the pathology of the digestive organs. Practically all kinks and adhesions precede the inflammatory stage, which is thought to be due to microorganisms and which may lead to ulceration, perforation or degeneration of the affected or neighboring organs. In order to demonstrate that this assertion is correct I must prove that the conditions observed at operation or at autopsy exist before microorganisms can possibly have any effect on the organs. We must, therefore, study the digestive organs of normal still-born infants, in whom the digestive organs are sterile. At this time only about 60 still-born infants have been studied, but continued daily observations confirm the points of view and the facts brought forward in this paper.

FIG. 1. Common appearance of the abdomen in the still-born. Note the transverse colon disappearing under the right lobe of the liver, taking the course schematically outlined in Figure 2.

In a still-born child the liver is seen to occupy the whole upper abdominal region. The division between the right and left lobes is located in the middle of the abdomen and is marked by a deep incisura. In about 6 cases out of 10 the transverse colon appears in the abdomen only from this incisura up to the splenic flexure. The right portion of the transverse colon is not seen. It seems to crawl under the liver between the right and left lobe as shown in Figures 1 and 2. If the right lobe of the liver is raised the course of the right portion of the transverse colon is plainly seen. It takes an upward course to the under surface of the liver and then bends towards the pelvis to form the descending colon. I would emphasize the enormous importance of the direction taken by the right portion of the transverse colon, while hidden under the liver. Of great importance also is the position of the stomach. It presents itself crowded under the liver as an exceedingly narrow, almost straight tube, not resembling in any manner the stomach of extrauterine life. The great omentum is practically never found distended over the abdomen as in adult life. It is folded over the transverse colon and is

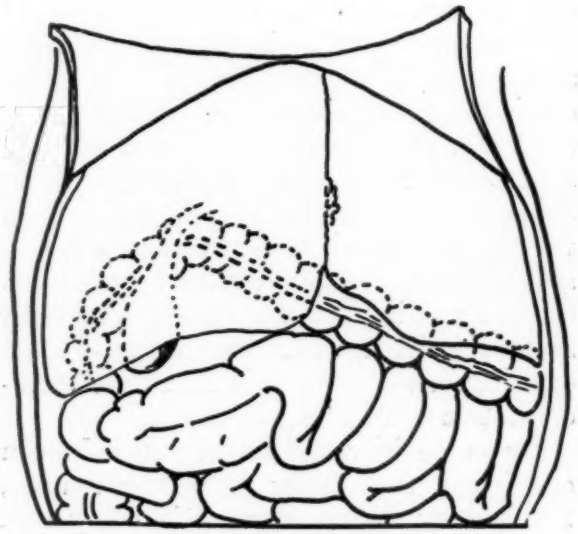

FIG. 2. Schematic drawing of relations in the upper abdomen of the still-born.

extremely thin and fragile. The right portion of the transverse colon, hidden under the liver, in reaching the upper point in its upward course comes in immediate contact with the gall bladder, the cystic duct, the portal vein, the hepatic artery, the lesser omentum, the first and part of the second portion of the duodenum and the pylorus.

This condition is observed only in the still-born; changes occur in the baby who has lived even only a few hours. The transverse colon as described above is exceedingly great for the following reasons: in normal conditions the lesser omentum and the mesocolon of the right portion of the transverse colon are two distinct structures. In some cases, however, they become fused together and this fusion prevents the corresponding portion of the colon from descending as in normal conditions. The greater omentum may also become adherent here and there and cause malformations and malpositions.

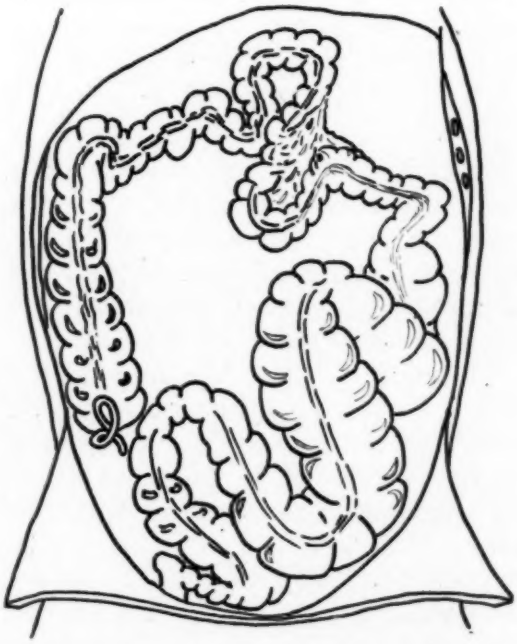

Fig. 3. Numerous kinks and adhesions in the still-born. Note the kinked appendix in immediate contact with a loop of the sigmoid, which is shown to be immensely distended, elongated and kinked by a large quantity of meconium. Note adhesions and kinks in the transverse colon.

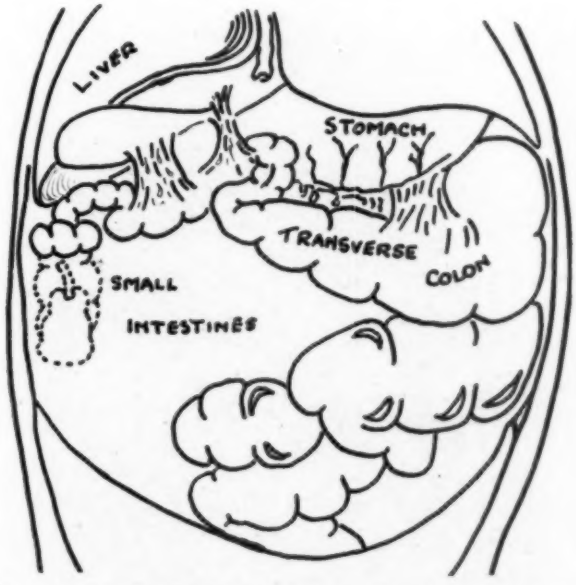

Fig. 4. Another still-born infant. Showing numerous adhesions and kinks. The transverse colon is adherent to the liver, gall bladder and stomach; on the left the transverse colon is greatly distended by meconium, while on the right it is markedly contracted and kinked. The appendix, retrocecal and ascending colon are shown in dotted lines.

stomach dilates and pushes downward and to the right that portion of the right transverse colon that was in contact with it. The uppermost point of the transverse colon, which was practically wedged between the gall bladder and the second portion of the duodenum, is also pushed down by the second portion of the duodenum itself, which becomes dilated. The right transverse colon, which was hidden under the liver, descends and becomes evident in the abdomen. The importance of the position of the right portion of the

What is the result of the fusion of the mesocolon and the lesser omentum? In the erect position the result is a continuous more or less severe pulling on the lesser omentum and consequently on the pylorus, first and second portions of the duodenum, portal vein, pancreas, the hepatic, cystic and common ducts, and the gall bladder; continuous mutual interference of function of these organs during digestion, when the colon is filled, creating conditions of stasis, interference with lymphatic and blood circulation, and consequently favoring the growth and action of microorgan-

isms. At times this fusion involves any of the other organs, especially the gall bladder, and then the anatomical defect becomes more evident and the pathology more easily understood. In this paper I cannot discuss all the pathological alterations that may follow the conditions described above. I will only emphasize the fact that these adhesions are not due to infective processes, that they develop in utero and that the common changes observed later in life are due to the

Fig. 5. Case 1. Roentgenogram, three and one-half hours after barium meal.

conditions I have described. It is clinically important that these conditions can be diagnosed and properly treated in adult life. I have been able to make the correct diagnosis in over 50 cases, some previously operated on by very competent surgeons for chronic appendicitis, cholecystitis, etc., without benefit. The typical roentgen-ray picture of the cases is an angulation of the transverse colon more or less close to the spine, as here illustrated. To avoid repetition and save space I show only a few illustrations and cases which are typical.

Case 1. F. B., male, aged thirty-four years, referred by Dr. Gade.

Roentgen report by Dr. W. M. Priest on films of this case: "1. Stomach of normal size and contour. 2. The cap is irregularly deformed by spasm and adhesions, which I believe arise from chronic gall-bladder disease. 3. The appendix is long, segmented, tender, and adherent to the terminal ileum, close to the ileocecal valve. Therefore, I believe it to be pathological. 4. At the point of the hepatic flexure, there appears to be a decided tendency for this part of the gut to be displaced posteriorly. 5. There is marked spasticity throughout the entire colon. 6. There is redundancy of the sigmoid. 7. There is no evidence of calculus in the kidney, ureter, nor bladder."

The series of films in this and other cases show how constant is the acute angle formed by the right portion of the transverse colon at about 3 cm. to the right of the spine. At operation it was found that the mesocolon and the lesser omentum were fused together, and the appendix was slightly kinked but otherwise normal. The patient had a subicteric color and was suffering from vague digestive troubles and constipation, and had had two attacks of severe abdominal pain, diagnosed as appendicitis. Subicteric color, constipation and digestive symptoms disappeared after operation.

Case 11. P. M. R., aged nineteen years, one pregnancy. Referred by Dr. Matera.

Roentgen report by Dr. W. M. Priest on this case: "1. There are no constant defects in the stomach or the first portion of the duodenum that would indicate an abnormality. 2. The cap and the second portion of the duodenum are firmly fixed to the right. This, I believe, is the result of adhesions from a pathological gall bladder. 3. There is very marked hypermotility with spasticity throughout the entire intestinal tract. At the end of the fourth hour the head of the meal had reached the rectum. 4. There are adhesions involving the lower part of the cecum which are the result of a pathological appendix, which is visualized, kinked, segmented, and tender on deep pressure. 5. Some fixation of the hepatic flexure. 6. The stereoscopic films of the colon after the

barium enema reveal a normal rectum, marked redundancy of the sigmoid, kinking in the mid-descending colon, and spasticity of the transverse colon. Near the hepatic flexure there is marked angulation and the hepatic flexure recedes into the posterior plane. There is slight ileo-cecal leakage."

At operation: the gall bladder was found normal, but there was very marked fusion of the mesocolon and the lesser omentum, which interfered with the emptying of the cystic and common ducts; the appendix was slightly kinked but normal; the transverse colon from the point that was fixed to the lesser omentum to the hepatic flexure formed a loop about 10 cm. long, kinked upon itself. The patient, who had always been constipated, has had normal movements since the fifth day following the operation. Digestive troubles completely disappeared.

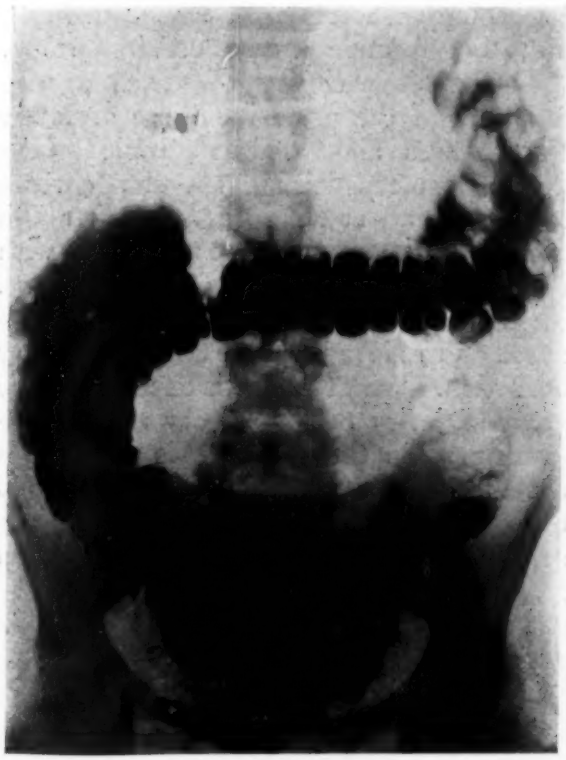

Fig. 6. Case II.

Case III. S. R., male, aged thirty-eight years. The patient was always constipated and dyspeptic. Appendix had been removed about eight years previously. At operation it was found that the transverse colon was adherent to the pylorus, with fused mesocolon.

Stereoscopic roentgen-ray pictures show that the colon recedes into a posterior plane. At operation it is found that the mesocolon and lesser omentum are fused together. This fusion, however, is not easily appreciated and only a trained eye will notice it and a trained hand will be able to free the adherent structures properly. The fusion of the mesocolon with the lesser omentum explains also the condition shown in Figure 7. On the right the colon takes a v-shaped form because there is a long loop between the point of fusion and the suspensory ligament of the hepatic flexure. This condition I have met five times at operation, and four times at autopsy: twice in adults, once in a child two weeks old, once in a still-born infant.

Fig. 7. Case III.

In this paper I shall only mention the condition of the appendix in the still-born. Four out of 10 show kinks of the appendix, with adhesions, and short mesenteries, exactly as observed at operation or at autopsy. This fact also proves the contention that these kinks and adhesions precede the infectious processes that call for operation. Contrary to the accepted

opinion, the causa prima of acute and chronic appendicitis is an anatomical defect, that is, congenital kinks and adhesions, not microorganisms.

In clinical observations I have noticed that patients suffering from digestive disturbances present the following triad: fusion of mesocolon and lesser omentum, kinked or adherent appendix, long sigmoid. This triad exists in the still-born; 4 out of 10 have an exceedingly long and dilated sigmoid. On the importance of this condition I am collecting material to be published later. (Also see illustrations.)

CONCLUSIONS

I have described anatomical faulty conditions that cause and precede pathological processes observed in the digestive organs such as ulcers of the stomach and duodenum, carcinoma of the stomach, pancreatitis, duodenitis, cholecystitis and cholelithiasis, stenosis and obstruction of the intestine, acute and chronic appendicitis, and chronic constipation. It is my contention that microorganisms would not cause any lesion if the faulty anatomical conditions described did not exist.

In order to cure the pathological conditions mentioned the faulty anatomical structure must be corrected first.

By improving our methods we may succeed in diagnosing these conditions early in life and by a very simple and harmless operation prevent later serious developments such as ulcers of the stomach and duodenum, carcinoma of stomach and intestine, pancreatitis, cholecystitis, cholelithiasis, stenosis and obstruction of the intestine, acute and chronic appendicitis and chronic constipation.

The stage preceding the gross changes resulting in the formation of ulcers, carcinomas, calculi, perforation, stenosis, obstruction, etc., is not due primarily to the work of microorganisms. It is due to anatomical defects formed during intrauterine life, the fusion of portion of the transverse mesocolon with the lesser omentum being the most frequent and most important.

The great majority of patients who complain of the usual indefinite digestive disturbances, diagnosed as chronic appendicitis, cholecystitis, dyspepsia, chronic constipation, etc., actually suffer on account of the fusion of the mesocolon with the lesser omentum, as herein described. Their condition can be successfully diagnosed and relieved by safe and satisfactory operation. Complete cure is obtained in the great majority of cases, very marked improvement in the others. This assertion is based on over 50 cases I have observed and operated on in the last four years in my services at the Greenpoint and Flower Hospitals.

I wish to express my thanks for the assistance rendered by Dr. Nidish, pathologist of the Greenpoint Hospital, and to Dr. Ratner, intern, who sketched illustrations 1 to 4 during autopsies.

ROENTGENOGRAPHY IN THE DIAGNOSIS OF GASTROINTESTINAL PERFORATION*

M. H. TODD, M.D., F.A.C.S.

LYNCH, KY.

I WISH to call attention, in this brief report, to the importance of the routine use of the roentgen rays in the diagnosis of suspected perforation of the gastrointestinal tract.

Our attention was first called to the subject by the article of G. H. Copher[1] and later that of Vaughan and Brams[2] appearing in 1924. These writers state that the presence of air or gas in the peritoneal cavity can be demonstrated with great certainty by the use of the roentgen ray, and that the diagnosis of perforated duodenal ulcer is thereby made much more definite. A recent brief review of the literature shows that a number of other authors have also described spontaneous pneumoperitoneum and its detection by the roentgen ray, among them Lenk as early as 1916, Dandy in 1917, and more recently Guillemin, Kellogg, MacCharles and others.

In spite of this considerable literature, however, inquiry at several hospitals has disclosed the fact that the method is not in general use. We believe it of the utmost importance in this field, where accurate diagnosis is vital and often very difficult. I wish here to record our experience with it.

Since November, 1924, we have made it routine to take roentgenograms whenever perforation of any sort has been suspected, whether ulcerative or traumatic. All but one of our cases have been traumatic. We are very much impressed by the clearly defined results of the method, and are led to consider that when a bubble of gas is detected in the peritoneal cavity in the roentgenogram, it constitutes the strongest evidence that can be obtained of the presence of perforation; and we believe that a consistently negative roentgen-ray finding speaks almost as strongly against its existence. There is an exception in the case of the appendix; perforations of this viscus are said to show no gas in the peritoneal cavity as the rule. It is also said that perforations of the stomach may not with certainty give rise to pneumoperitoneum, for this organ may occasionally contain no air, although it generally does. I have no evidence to bring forward on these points, for our cases have concerned the intestine itself.

We have had 10 cases, listed below, in which there was a well-defined possibility of perforation. In the first 4 of the list, perforation was present and found at operation; in the fifth, no autopsy was permitted, but the location of the wounds made perforation a certainty. In these 5 cases, the roentgen-ray findings were positive.

In the sixth case, the location of the wounds made it certain that some of the abdominal viscera had been damaged, and laparotomy was performed in spite of the negative roentgen-ray findings; the sign was thought to have failed. A ruptured spleen was the only lesion found, however, and prompt recovery followed its removal. In the 4 remaining cases, no perforation existed to our knowledge; they all recovered without operation. In these 5 cases, the roentgenograms gave negative findings.

In all of our small series, then, the procedure has given consistently accurate results whether negative or positive.

[1] Copher, G. H. Demonstration of spontaneous pneumoperitoneum by roentgen ray; an aid in diagnosis of acute perforating peptic ulcer. *J. Am. M. Ass.*, 1924, lxxxii, 781.

[2] Vaughan, R T., and Brams, W. A. Early recognition of acute perforation of gastric and duodenal ulcer by *X*-ray examination of spontaneous pneumoperitoneum. *Surg., Gynec. & Obst.*, 1924, xxxix, 610–617.

* From the Lynch Hospital of the United States Coal & Coke Company, Inc.

The technique that we have used has been very simple: the patient has been made to sit up for a moment, when everything was in readiness, and a film was then placed anteriorly, so as to show the lower chest and upper abdomen. Double screens were used, and the exposure made was very brief, a second or less, the patient being instructed to hold his breath for a moment to fix the diaphragm.

The findings have been perfectly definite; the slightest quantity of gas appears on the film with beautiful distinctness as a narrow sickle-shaped dark zone, separating the liver from the diaphragm above it. It is most important to secure momentary immobility of the diaphragm, since any slight movement might obscure a very narrow zone of gas. In case of any doubt, the roentgenography should be repeated, the upper border of the liver being made to appear very sharp and clear cut on the film.

We have not depended upon simple fluoroscopy in our cases, because the eye, being much less delicate than the film, might fail to discern a very narrow zone of gas. In this respect our technique differs from that of Vaughan and Brams.

REPORT OF CASES

Case I. I. F., male, colored, admitted November 16, 1924, with multiple gunshot wounds, including one of the right chest.

The wound of entrance was two finger-breadths above the costal margin, in the right axilla, the ball lodging in the right lumbar region, somewhat lower down. Patient was seen by me nine hours after admission, and at that time a single small spot of abdominal tenderness was present, somewhat above and external to McBurney's point. White blood cell count 20,000. Pulse 100, excellent quality. Patient did not feel ill.

Five hours later, fourteen hours after admission, patient was examined again; he had felt worse during the preceding two hours, with more pain in the abdomen and with more rapid respiration; there was somewhat more tenderness in the small area noted above, still sharply localized.

Roentgenogram taken at this time revealed presence of bubble of gas above liver. Immediate operation showed beginning general peritonitis, not yet severe, with general injection of all the intestines. There was a small amount of free fluid near hepatic flexure of colon; and a single small perforation, the ball having just grazed the intestine in passing into the lumbar muscles.

Convalescence was uneventful; patient is now in perfectly good health.

Comment: the roentgen-ray examinations should have been made much earlier; we were then not familiar with the procedure, it being our first case.

Case II. N. P., male, white, admitted December 6, 1924.

The patient was sent in from another mine, the case being diagnosed as severe contusion of the abdomen. He had been injured an hour before admission by a fall of slate, a timber being driven violently against the abdomen. (Patient stated to a friend that his abdomen felt as if it started to swell at once, though this was not known to the writer until after operation.) There was considerable shock on admission, with severe pain in the chest and pelvic region. Roentgenograms showed the pelvis and chest negative to fracture. There was quite a little tenderness in the lower abdomen, right side, with definite protection. Morphine had been given at the mine. White blood cell count was 16,000. Patient was placed under observation, as in acute abdominal conditions. No more opiates were administered.

Two hours after admission, the white blood cell count had fallen to 6000, suggesting much lowered resistance. There was steadily more pain in the abdomen; patient felt very ill.

It was decided to operate at once. During preparation, a roentgenogram was taken, the patient sitting for a moment. A gas bubble was present between the liver and diaphragm. This roentgenogram was taken purely to corroborate the diagnosis of rupture of the intestine; operation would have been performed in any case.

Operation disclosed free bloody fluid in the peritoneal cavity, with corn and other fecal material floating about. Lateral aspect of cecum and ascending colon were torn widely open, mesocolon was also extensively torn.

Viability of gut seemed questionable at first; apparently better after repair of tears. Repair was rapidly effected with catgut, drainage placed in pelvis through stab wound, as well as

to the region of the cecum. Speedy closure with simple through-and-through sutures.

Case III. J. O., male, white, admitted January 22, 1926.

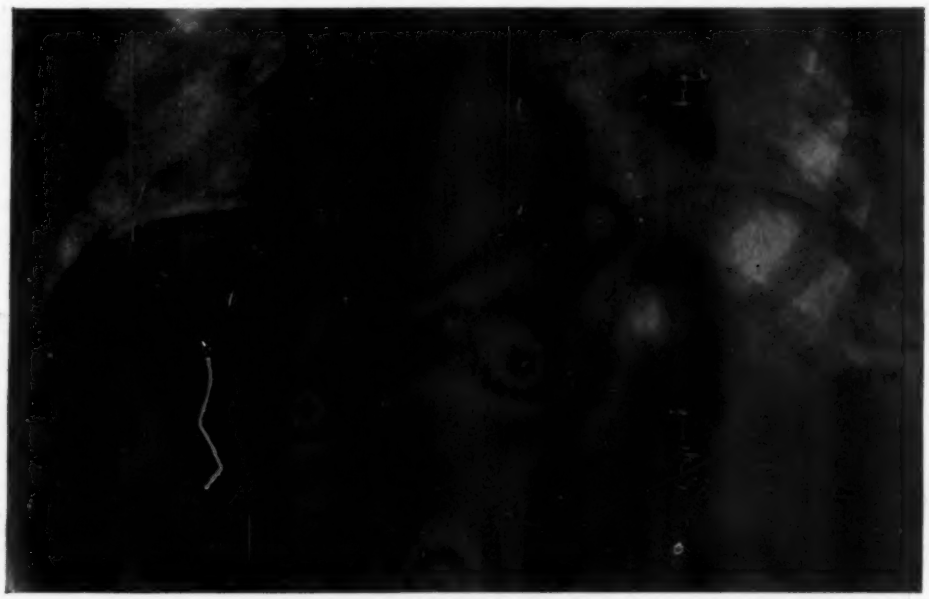

Fig. 1.

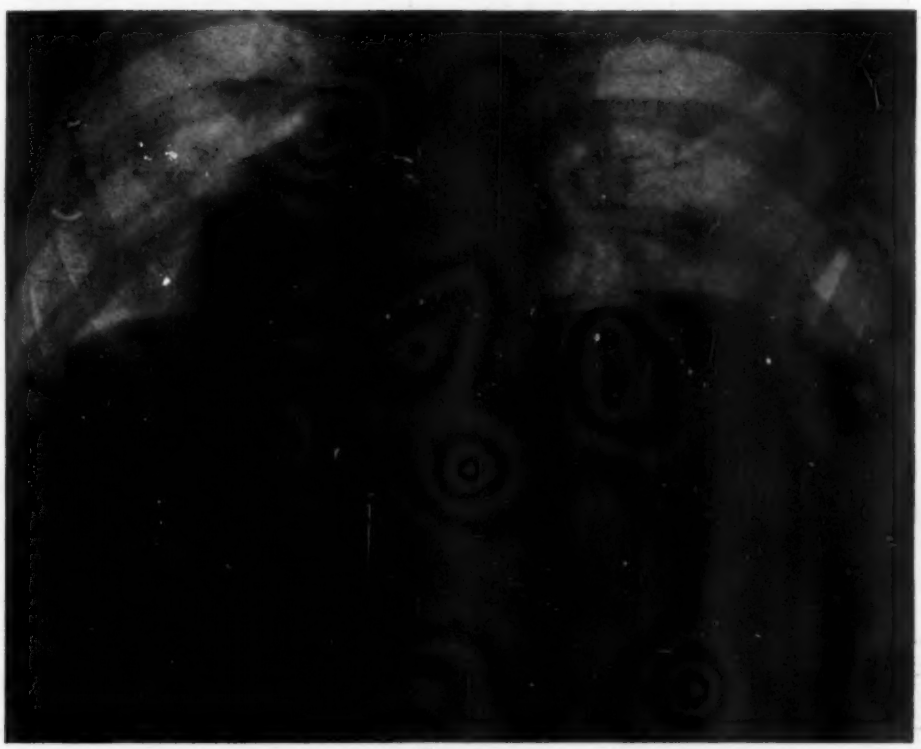

Fig. 2.

Profound shock occurred; intravenous saline was given on the table, with the other usual measures of stimulation. The patient died twelve hours after operation.

When admitted, patient was suffering acute pain in the right upper abdomen, radiating toward the left scapula, with intense vomiting, of several hours' duration. Some relief was

obtained by bending over a hot radiator. On admission, marked rigidity in right upper quadrant of abdomen, apparently involuntary, was noted.

There was a history of prolonged trouble in right upper abdomen, reasonably typical of gall-bladder disease. Had been treated for cholecystitis.

Roentgenogram was taken, the patient sitting up for a moment as usual, for the reason that there was marked rigidity, actually board-like, though when seen by me, three hours after admission, the pain was only intermittent. Gas bubble was found between liver and diaphragm. Immediate operation was insisted upon. Diagnosis was perforation of some viscus, probably duodenal ulcer.

Operation showed perforated duodenal ulcer near pylorus, gall bladder negative. Perforation was closed and posterior gastroenterostomy done.

Patient was seen two months after discharge from hospital; recovery was excellent, convalescence perfectly uneventful. Modified Sippy diet was continued. Patient now works regularly.

Case iv. H. M., male, colored, admitted August 4, 1926.

Patient was injured three days before admission, receiving a gunshot wound in the right lumbar region, the ball ranging upward. He was retained in jail for two days before being brought to the hospital.

Examination showed a thin young colored man apparently not critically ill, with some pain in left lower abdomen, tenderness and some protection. Pulse, respiration and temperature were about normal. Roentgen-ray examination showed a bubble of gas above the liver.

Fig. 3.

Operation disclosed multiple perforations of the small bowel, in the upper portion; two or three of these were closed over by adherent loops of intestine, so that there was no leakage; there was open leakage from two. The perforations were sutured and the wound closed with drainage. There was only a mild peritonitis present.

Patient's general condition became very precarious forty-eight hours after operation; he made a good response to stimulation; a fecal fistula manifested itself after several days. August 18, 1926, general condition was quite satisfactory, though there had been a recent severe attack of abdominal pain, apparently

brought on by overeating. Patient was still in the hospital. The patient died ten days later, incomplete autopsy showing general peritonitis.

Case v. R. P., male, colored, admitted February 8, 1925, with multiple gunshot wounds of trunk, abdomen and chest. Shock was not marked at first; pulse was 72. Preparation was made for emergency operation. In the interval, a roentgenogram was taken, the patient sitting for a moment. Gas bubble was found between liver and diaphragm.

Before anesthesis was begun, the patient became much weaker, his general condition being so unfavorable as to prohibit any interference. Death occurred nine hours after admission.

The roentgenogram in this case was made within an hour after the injury occurred. The location of the wounds made it certain that intestinal perforation had occurred.

No autopsy was permitted.

Case vi. J. K., male, colored, admitted January 23, 1926, with a self-inflicted wound of the left chest, a little below the heart, perforating anteroposteriorly, by a pistol ball.

The injury occurred a few minutes before admission. There was a little shock, the patient feeling weak and sick. The location of the wound made it certain that some of the abdominal organs must have been injured. A little tenderness was present in the left upper quadrant.

Exploratory operation was planned to be done at once. (In the interval, amputation of an arm in another case was done, seemingly a greater emergency; this permitted primary shock in the gunshot case to subside, as well.)

Roentgenogram was taken with the patient sitting, an hour after admission. It showed negative findings as to gas bubble and to fluid in the left chest.

Fig. 4.

Operation was performed, nevertheless, because of the location of the wounds. A severe laceration of the spleen was found, with some bleeding continuing. Careful inspection of the stomach and neighboring intestines showed no injury to them. Splenectomy was performed, closure made without drainage.

Recovery from the operation was excellent. Left hemothorax slowly developed, and was treated by aspiration. Recovery has been complete, patient now being apparently normal.

Case vii. L. T., male, colored, admitted February 17, 1926, with a stab-wound in the left side of the abdomen, of questionable depth. Roentgenogram, made with the patient sitting, showed no gas bubble above the liver.

Treatment: Patient was placed under observation as in acute abdominal conditions; simple dressings were applied.

The wound healed without complication and without evidence of injury to the viscera. Convalescence was entirely uneventful.

Case viii. W. J., male, colored, admitted February 26, 1926, with gunshot wound in right flank, from below upward, the ball lodging near the angle of the right scapula. Injury to the abdominal viscera was possible from the location of the wound. Roentgenogram was taken in the usual way, and found negative as to gas bubble.

Treatment was expectant, as for acute abdominal conditions. (The patient also had a gunshot fracture of the humerus, which was treated as usual.)

Recovery was perfectly good; the patient left the hospital against our advice.

Case ix. J. M., female, colored, admitted March 13, 1926, with stab wound just below the right costal margin, 2 inches from midline. Patient was somewhat intoxicated; bleeding was considerable, no actual shock. Abdomen was tender in right upper quadrant, with slight tenseness, apparently voluntary. There was no tenderness elsewhere.

Roentgenogram was negative as to pneumoperitoneum. Treatment was expectant, as in acute abdominal conditions; no opiates were given, sips of water only.

Roentgenography was repeated eight hours after admission, and still showed negative findings. Abdomen was slightly more tender after twelve hours and held a little stiffly; tenderness was present also a little to the left. Tenderness was nowhere acute, however, and there seemed to be no actual involuntary spasm. White blood cell count was 21,000.

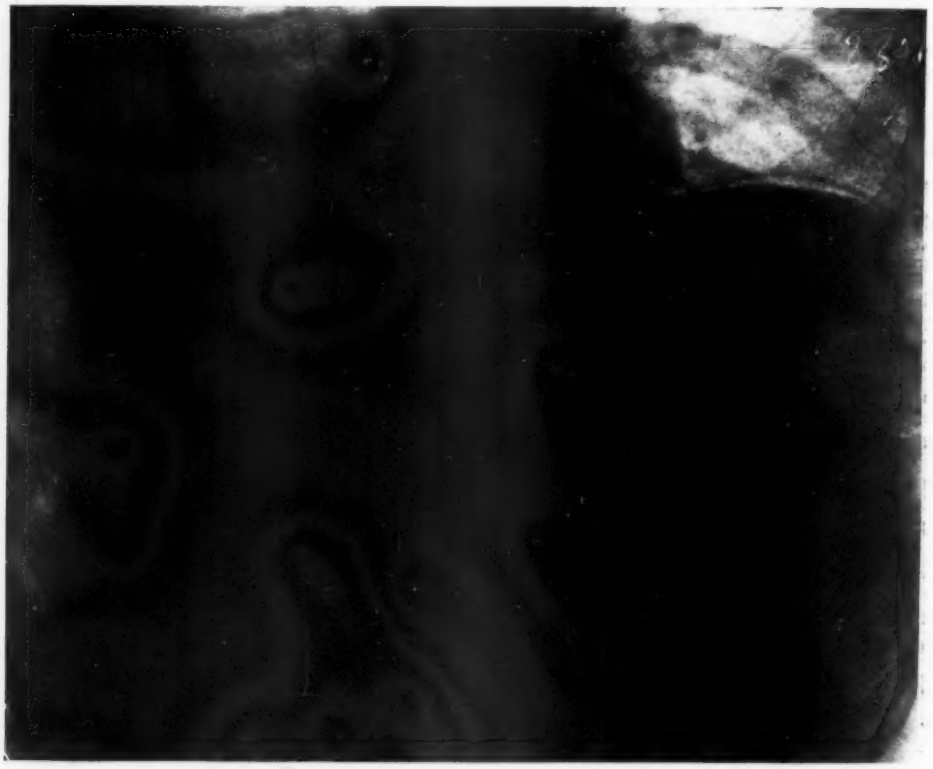

Fig. 5.

Twenty hours after admission, there was still considerable bleeding; thromboplastin was given intravenously. White blood cell count was 13,000.

Twenty-four hours after admission, there was considerable improvement, with less tenderness and very little bleeding. Temperature was normal, pulse 100.

Convalescence from this point was unevent-

ful. Patient was discharged one week after admission.

Comment: This is the first case in which definite reliance was placed in the roentgenogram for signs of perforation; inasmuch as it was negative, exploration was not done; otherwise there was sufficient tenderness to make it perhaps wise.

Case x. B. B., male, colored, admitted May 16, 1926.

This patient was treated during my absence. He was admitted with a gunshot wound of the right lower chest, perforating. Wound of entrance was two finger-breadths above the costal margin in the mammillary line; exit an inch lower in the posterior axillary line; length of bullet track about 6 inches. The liver was evidently perforated, possibly also the hepatic flexure of the colon. The man was drunk. There was free bleeding. The projectile was a .45 caliber pistol ball.

There were no abdominal symptoms. Treatment was expectant, as for acute abdominal conditions. After sixteen hours, abdominal tenderness developed, with some tenseness in the right upper quadrant. Temperature 102°F. Roentgenogram was taken with the patient sitting, with negative findings as to gas bubble above the liver. A small enema was given with caution, and gave relief.

Recovery was otherwise uneventful and complete. Patient was seen a month after injury, and was working daily.

CONCLUSIONS

We have found very consistent confirmation of the fact, reported independently by several writers, that gastrointestinal perforation may be diagnosed by noting the presence of a gas bubble above the liver in the roentgenogram. We believe it to be by far the most important single sign of the condition and it is easily demonstrated even where the perforation is minute. It appears to me that the use of the roentgen ray is here nearly as important as it is in the diagnosis of fractures, and that it should be employed in all cases where it is at all possible, or where any reasonable doubt exists as to the condition present.

A feature of extreme importance is the fact that perforation may thus be diagnosed very early, much before other signs may become definite, perhaps within an hour; far earlier, of course, than any tympanitic note could be detected on percussion. The attempt to demonstrate loss of liver flatness, for instance, in suspected typhoid perforation, would appear to be a much less delicate method of diagnosis.

The technique is very simple, though exact; momentary fixation of the diaphragm is essential; and the making of a film, not simply fluoroscopy, seems to us decidedly the method of choice.

A negative finding is apparently nearly as significant as a positive one; certainly it is of great value, though other signs, as in the case with ruptured spleen, may make exploration imperative even when the roentgen-ray findings are negative.

LOOP OPERATION FOR PARALYSIS OF THE ADDUCTORS OF THE THUMB

LEO MAYER, A M., M.D.

NEW YORK

FOR the treatment of paralysis of the adductors of the thumb, two operations have been published, those of Ney[1] and Steindler.[2] In the Ney operation the extensor brevis pollicis is severed about 4 inches from its insertion, the distal free end is brought through a subcutaneous channel to the anterior aspect of the wrist and is there sutured to the palmaris longus. Though the operation improves the position of the thumb it fails, so far as I have observed, to give the normal range of strength to the opposing action of the thumb. Steindler's operation consists in splitting the flexor longus pollicis tendon longitudinally from its insertion down to the metacarpophalangeal joint and suturing one half the tendon to the dorsum of the proximal phalanx in such a way as to rotate the thumb towards the palm. Steindler reports excellent results and the operation is unquestionably a simple and ingenious procedure.

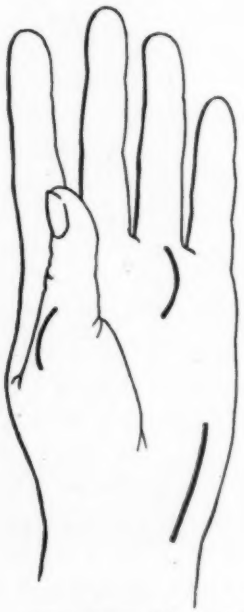

FIG. 1. The three skin incisions.

A third method, that of Sterling Bunnell of San Francisco, not yet published, deserves to rank with the Steindler in the excellence of its results. From the standpoint of operative technique it is significant since it demonstrates a new use of free tendon grafts. It was first demonstrated to me on the cadaver by Dr. Bunnell in January, 1926. The method consists, briefly, in the utilization of a free tendon transplant to form a pulley on the ulnar side of the wrist through which one of the flexor tendons is brought and then transferred subcutaneously across the palm to the base of the proximal phalanx of the thumb. This operation seemed to me superior to Ney's because the line of traction of the substituting tendon was more nearly that of the paralyzed adductors and therefore more nearly imitated the normal opposing action of the thumb.

Since the time of Bunnell's demonstration I have had opportunity to perform this operation in 5 cases of infantile paralysis involving the adductor muscles of the thumb. In all cases there was complete inability to oppose the thumb to the fingers. The technique of the operation, differing somewhat from Dr. Bunnell's method, retains the essential feature of the pulley. The steps are:

1. A semicircular incision 1 inch long is made over the base of the proximal phalanx of the thumb, the convexity directed towards the dorsum (Fig. 1). The skin flap thus outlined should be so placed as to expose the dorsum and by gentle retraction also the palmar surface of the phalanx. Through the phalanx about ½ inch from the joint a small drill hole is made, passing from the dorsal to the palmar surface.

2. A second incision is made along

the ulnar aspect of the wrist extending from a point corresponding to the level of the pisiform downward in a straight line for a distance of about 2 inches. The ulnar nerve is first exposed and carefully drawn aside, then the sheath of the flexor tendons (Figs. 2 and 3) is opened and the tendons inspected to determine which are suitable for transplantation purposes. As a rule, I have selected the flexor sublimis tendon of the third finger for the free graft to construct the pulley

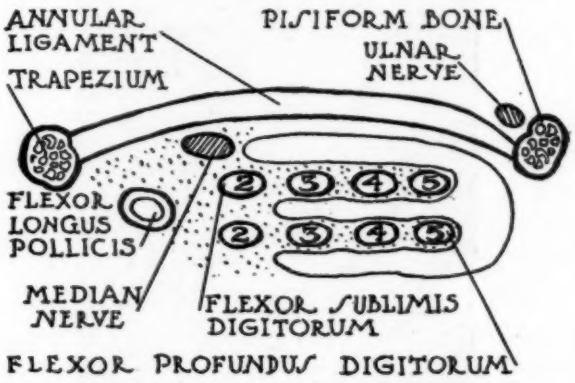

Fig. 2. Diagrammatic cross section through the anterior portion of the left wrist showing the relationship of the chief tendons and nerves. Exact knowledge of the anatomical arrangement is essential to proper execution of the operation.

and the flexor sublimis tendon of the fourth finger for the transplant to the thumb. The tendon loop must be strong enough to withstand the lateral pressure that is going to be brought against it by the transplanted tendon. The free tendon graft must be about 1½ inches long. It is threaded at each end with a braided silk stitch and this is then brought through a small tunnel in the muscles and fascia just distal to the unciform bone (Fig. 3). The two ends of the tendon are not united yet but are left open so as to make the transplantation of the tendon to the thumb somewhat simpler.

3. The third incision is made at the base of either the fourth or the third finger, depending upon which of the sublimis tendons has been selected as a substitute for the thumb tendon. The incision is about 1 inch long and is placed somewhat to the ulnar side of the midline of the finger but not so far over as to injure the digital nerve. The sublimis tendon is identified, is cut transversely and is then freed from the peritenon as far upward as possible. The corresponding tendon is then located in the carpal sheath and by a quick snapping motion with any blunt instrument the tendon is snapped out of the palm. If care has been taken to divide the peritenon as far upward as possible this procedure is accomplished quite easily.

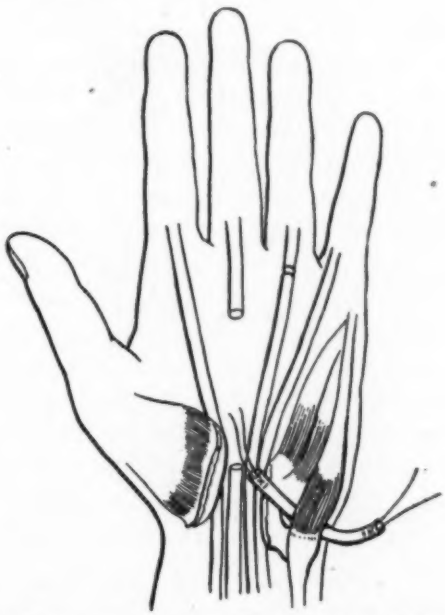

Fig. 3. A section of the sublimis tendon of the middle finger has been removed, threaded with a silk stitch at each end and brought through a musculo-fascial tunnel just distal to the unciform bone. The sublimis tendon of the fourth finger has been divided at the base of the fourth finger preparatory to its transplantation.

4. The free ends of the tendon graft that are to form the loop are now brought around the substituting tendon of the sublimis. They are united to one another and then the tendon loop is rotated a little so as to bring the suture inside of the muscle tunnel. The free end of the sublimis tendon is brought through a subcutaneous channel running transversely across the palm over to the base of the proximal phalanx of the thumb (Fig. 4).

5. The end of the sublimis tendon is now threaded with No. 2 braided silk and this

silk strand is passed through the drill hole in the proximal phalanx of the thumb. Care should be taken that the direction of the tendon should be from the dorsal surface of the thumb towards the palmar. This will insure a much stronger opposing action than if the reverse direction is followed. The tendon should be long enough so that it will pass completely through the bony canal and can be sutured to itself. All the wounds are closed by means of fine

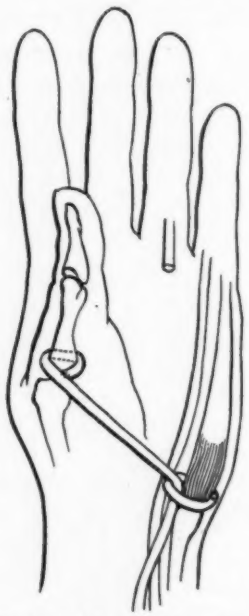

Fig 4. The sublimis tendon of the ring finger has been passed through the loop formed by uniting the two ends of the free transplant of the sublimis tendon of the middle finger. The free end of the ring finger tendon has been brought diagonally across the palm and drawn through a drill hole in the base of the proximal phalanx of the thumb. The drawing illustrates the line of traction exerted by the transplanted tendon.

fascial stitches and continuous sutures for the skin. As a rule 00 plain catgut is used for the skin sutures. The thumb is fixed in a position of opposition by means of adhesive plaster strips. It is kept immobilized for a period of fourteen days and then gentle active exercises are begun. These must be kept up for a period of at least six weeks to secure the maximum effect of the transplanted tendon.

Comparing this operation with Steindler's it has the advantage that it fully reproduces the effect of the paralyzed adductor muscles. It has the disadvantage of being a somewhat complicated procedure necessitating more extensive incision and dissection. The practical results are unusually gratifying. In all 5 cases operated on by me there has been excellent opposing action of the thumb and the usefulness of the hand has been much improved. It has been of particular interest to note the free gliding of the transplanted flexor tendon

Fig. 5. Photograph illustrating the opposing action of the thumb after the operation. The tendon can be seen in its course across the palm.

and the action of the tendon loop. A genuine pulley seemed to have been constructed closely resembling that of the omohyoid muscle. These results would seem to be another proof that with adequate care, free tendon grafts can be utilized without destroying the gliding function of the superficial tendon cells.

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PHYSICAL THERAPY

AN AID TO MORE PERFECT SURGICAL END-RESULTS

WILLIAM LEE SECOR, A.M., M.D., F.A.C.S.

KERRVILLE-ON-THE-GUADALUPE, TEXAS

SURGICAL technique is today very largely standardized. An appendix is removed in much the same manner in New York City as in San Francisco. A hysterectomy is about the same procedure in Hong Kong as in Vienna. The surgeons of Texas in dealing with the thyroid use a very similiar technique to that employed in Illinois and Minnesota.

It is not, then, so much to improvements in surgical technique that we must now look for the production of more perfect end-results as to a more detailed preoperative study of our cases and a more intelligent and painstaking after-treatment.

A high percentage of the patients consulting a surgeon have been sick a long time. Many of them have tried various physicians and sundry cults before the surgeon is appealed to, for all too often even today he is regarded as the court of last resort.

These patients are sick in mind as well as body; they have sick habits; they think sick thoughts. Simply to perform a hysterectomy, a cholecystectomy or any other operation on patients of this class and turn them loose will produce perfect end-results in very few cases indeed.

If these same patients were to consult a Christian Scientist, a chiropractor or any one of a dozen pseudoscientific cults, the chances are ten to one that for a while they would apparently be benefited, long enough for the cultist to make good advertising of it at least.

The cultists get their results almost entirely through psychology. They change the patient's thoughts, breaking up wrong thought habits; they impress the mind weakened by disease and implant suggestions there that produce what to the uninformed seem almost miraculous results.

Of course these seemingly wonderful cures of the cultist are only very transient and temporary in the cases where true organic disease is present and a wrong diagnosis or too vivid imagination will explain the others. In any case, however, the surgeon who studies and uses psychology can bring his patient to the operating table in better condition for the operative ordeal and can surely secure far more perfect end-results in the chronic cases.

It is natural for sick persons to want something done for them; they like personal contact, the touch of a hand, the use of heat, light, electricity, etc., anything that gives the suggestion of action, that the physician is really doing something.

I have often thought that if the various modalities employed in physical therapy, and now rapidly being placed on a scientific basis, had no intrinsic value but depended entirely for their benefit upon the psychic effect produced, they would still be a tremendous force in the armamentarium of every thinking surgeon. Anything that will intensify the effect of therapeutic suggestions will aid in securing better end-results in chronic cases.

The very reason, however, why physical therapy is not more generally employed by leading surgeons, the reason why, until lately, only a few hospitals had installed adequate equipment, is that the great majority of physicians and surgeons have taken it for granted that psychic effect is the alpha and omega of physiotherapeutic efficiency.

In the winter of 1906 and for a number of years thereafter I gave a course of lectures to students and physicians in one of our largest medical centers on physical therapy as an adjunct to modern medical and surgical practice.

The majority of my colleagues seemed to think that I was wasting my time. In 1915 I read a paper before a large county medical society in which physical therapy was recommended as an aid to more perfect postoperative results. After the meeting a leading surgeon of the city expressed himself on physical therapy in general and my paper in particular as "a lot of bunk."

This surgeon went to France as a major; in 1920 he was again well established in new city offices with a suite of treatment rooms adjacent and a physical therapist in charge. The World War spoiled some good surgeons, but it let a little education into others of the ultraconservative type.

The fad and fanatic stage of physical therapy is now rapidly passing; modalities of proven merit that can be placed on a scientific basis will be continued and elaborated while a number of measures of doubtful efficacy will be dropped.

Twenty years ago Mumford of Harvard taught: "I have employed massage for years in fracture cases that have come under my care, and am constantly impressed with its advantages—in the hastening of repair, in the early restoration of function, perhaps, best of all, in the sense of well-being given at the time, and in the feeling of security and confidence as soon as the patient reaches the stage at which active movements begin to succeed these passive ones. Under the old-fashioned treatment the arm was like a prisoner confined for weeks in a dark, narrow cell, to emerge at the last, pale, timid, spiritless, broken down—who must wait weeks yet before his proper vigor returns to him. With massage you let in air and light upon your captive; his windows are thrown open daily, and he is taken out for a brisk walk, as it were, about the prison yard. At the end of his confinement he returns to the former life with his force but little abated and his zest sharpened for the work of the world.

"There are numerous other conditions in which massage is of the greatest value, especially in contractures and deformities left by old injuries or inflammatory processes which have subsided. In those cases patience and faith are often required for a long time, but the final results usually justify the treatment. As to the use of general massage after major operations and prostrating surgical affections, let me say that I have employed it commonly in such conditions, and with the most gratifying results, for the secretions are thereby increased, the circulation improved, the appetite, sleep, and mental state stimulated, and the convalescence, after the patient's getting out of bed, materially and happily abridged." Today surgeons everywhere are beginning to see the truth in this.

I well remember how enthusiastic Ochsner of Chicago became over the improvement in wound healing under the simple incandescent light. Today actinotherapy, electrotherapy, hydrotherapy, massage and other physiotherapeutic measures are being placed on a solid footing and it is possible for graduate nurses to specialize in this field and make themselves indispensable to the wide-awake surgeon.

The time was when surgeons counted success by the number of patients that left the operating table still alive. Then it stretched to getting out of the hospital alive, then to how many years the patient lived after the operation. What surgeon today would be satisfied with mortality rate as the criterion of his success? Some are, but when you or I are operated upon we will prefer the surgeon who prides himself on end-results, small percentage of disability, the surgeon who attempts to restore his patients to a useful, helpful place in society.

When we find a surgeon of this type we will find a man who does not lose interest in his patient as soon as the last suture is placed; he will not turn the postoperative treatment over to interns and nurses. The patient is an individual to him whom he follows weeks, months and years postoperatively. It is only thus that perfect end-results can be made the rule.

As an aid in securing a smooth postopera-

tive convalescence and more perfect end-results in our clean cases, physical therapy will be found of the very greatest value. In relieving deep soreness, preventing vicious adhesions, restoring function of muscles and tendons, stimulating the general metabolism and to assist in driving home the proper therapeutic suggestion to correct unhealthful thought habits, the various modalities at our disposal will each show real worth. But it is in our pus cases, indolent ulcers, extensive sloughing wounds, bone infections and delayed restoration and repair of all sorts that we get our most spectacular results from a proper use of physiotherapeutic procedures as an adjunct to medication and surgical dressing.

If physical therapy will restore a producer to his place in society in a shorter space of time and with a smaller percentage of disability, no surgeon should be satisfied until he has at his disposal an efficient modern equipment.

The size of a city or the size of a hospital has nothing to do with the perfection of end-results; it is the size of the surgeon that counts most, and all the really big men will welcome any agency that will aid in improving our surgical end-results.

SPONTANEOUS RUPTURE OF THE DEEP EPIGASTRIC ARTERY:

A REPORT OF TWO CASES

HARRY B. EPSTEIN, M.D.

NEWARK, N. J.

NOTHING stimulates the interest of the surgeon so much as the unusual. The occurrence of so rare a lesion as spontaneous rupture of the deep epigastric artery twice within five months in the practice of one surgeon has in it almost an element of the bizarre.

CASE I. On March 17, 1926, a florid-faced, heavy-set man, aged forty-four years, weighing about 220 lbs., while at his usual occupation as a laborer, was suddenly stricken with agonizing pain in the right side of his abdomen, about 2 inches above the umbilicus. A swelling presented itself, rapidly growing larger, and Dr. William Rado was summoned. He found: Temperature, normal; pulse, 114 and regular; blood-pressure, 138/84; chest, negative; abdomen, tender; a swelling along the right upper and middle quadrant of the abdomen, 8 in. long and 3 in. wide, and projecting 1 in. from the abdominal wall. The patient was given morphine and taken to the hospital where I was asked to see him in consultation.

I found that the heart, lungs, and other organs were negative. There was a tumor on the abdomen, shaped like a parallelogram and of the dimensions mentioned above, with a bluish discoloration. It felt doughy, but did not fluctuate; there was no impulse upon coughing or straining; and it was irreducible. A preoperative diagnosis of probable rupture of the deep epigastric artery was made.

Operation was performed at 11 A.M., two hours after the seizure. An incision was made over the middle of the growth and a large amount of clotted blood was turned out. The tumor extended to the median line and laterally to the outer edge of the rectus muscle. After the blood was evacuated, there was bleeding from the deep epigastric artery and vein, which were torn. The ends of both vessels were tied with chromicized catgut, and the wound was closed without drainage. The subsequent course was uneventful and the patient left the hospital about one week after operation. He has been in perfect health since.

CASE II. On July 22, 1926, Mrs. R. D. was brought to the hospital, also by Dr. William Rado, with a diagnosis of spontaneous rupture of the deep epigastric artery, which I recognized on account of a similarity in the history with that of the previous case.

This patient, who had been treated by Dr. Rado for mitral endocarditis, was seized with a sharp pain in her right abdomen while sewing. The same type of tumor was found, but more extensive and spherical in outline, and deeper blue in color.

She was sent to the Newark Private Hospital and operated upon immediately under ether. An incision over the long dimension of the tumor was made; a large hematoma was turned out; the bleeding points of the ruptured deep epigastric artery and vein were tied; and the wound was closed without drainage. The patient remained in the hospital for four weeks. Digitalis was administered for her cardiac condition. She made a complete recovery.

In differential diagnosis we must consider the possibility of a hernia which, however, can be ruled out by absence of impulse on coughing and straining. The doughy "feel" is also encountered with an epiplocele.

We are obliged to speculate as to the cause of the vessel rupture. It would seem that it might be due to a localized arteritis or periarteritis, arteriosclerosis, or hypoplasia of the vessels, of which perhaps an infectious disease was the cause; or that a direct trauma may have damaged the

vessels making a later rupture possible. Very few cases have been recorded. Reporting one, Carey Culbertson[1] of Chicago cites the references to other instances of rupture of the deep epigastric artery and of the rectus abdominis muscle. In all these cases there seems to have been a previous history of trauma, operation or pregnancy. The 2 cases I have here reported are instances of true spontaneous rupture of the vessel.

[1] Culbertson, C. Hematoma occurring spontaneously in sheath of rectus abdominis muscle; etc. *J. Am. M. Ass.*, 1925, lxxxv, 1955–1958.

[SURGICAL SUGGESTIONS]

THE inguinal glands are never involved with testicular tumors unless the scrotal tissues are invaded or unless, rarely, the deposits in the abdominal glands have caused a backward growth through the iliac nodes.

HYDROCELE may be due to a testicular growth.

A PARAMEDIAN fixed tumor in the upper zone of the abdomen associated with a scrotal hydrocele would suggest that the latter conceals a malignant tumor of the testicle.

TRANSACTIONS OF
THE SECTION OF SURGERY
NEW YORK ACADEMY OF MEDICINE

Meeting of February 4, 1927

THE CHAIRMAN, DR. FREDERIC W. BANCROFT, PRESIDING

THE TREATMENT OF ACUTE SUPPURATIVE PLEURISY IN CHILDREN

JOHN V. BOHRER, M.D.

*(Abstract)**

SUPPURATIVE pleurisy in children presents a difficult problem. It is essentially a secondary disease, the child's vitality having already been depleted by primary pneumonia. Complications, such as acute otitis media or recurrence of pneumonia, especially in cold, windy months, are very common and these markedly increase the severity of the disease which in those under two years of age is in itself severe. The older textbooks of pediatrics state that the mortality in suppurative pleurisy in infants under one year of age is 100 per cent. Fortunately, this is not the case at present. In our series, the youngest patient operated on for empyema thoracis was three weeks old. This patient recovered as did many others in the infant group.

The plan of treatment should fulfill the following requirements:

1. Proper treatment of the primary disease with early recognition of the suppurative pleurisy.
2. Low mortality.
3. Minimum anatomical and physiological deformity.
4. Prevention of complications.
5. Early restoration to health.

Our general plan of treatment follows:

In the formative stage, if there is distress, aspiration is repeated as often as necessary. In a few instances, in streptococcus cases, where the reaccumulation of pus is very rapid, the air-tight syphon drainage or suction method is used. However, this is not entirely satisfactory; repeated aspiration is the better plan.

When the fluid is frank pus and, as is often the case, the fever from the pneumonia has abated, open drainage is instituted.

Intercostal drainage with the so-called "flapper tube" is the method used. A flapper tube is made by fitting a glove finger (one that has been softened by repeated sterilization) on the distal end of a fenestrated rubber tube as a projection, the tube having been cut with a 60 degree bevel, forming a valve that readily allows fluid and air to escape with expiration, but closes with inspiration. This is an aid in lung expansion, as it tends to restore the negative intrapleural pressure, and is of use in irrigating at the time of dressing, as it forms a funnel through which irrigating fluid is passed into the chest cavity.

The operation is always done with local anesthesia. The patient, if not too sick, is allowed to sit up; cooperation is more likely to be had in this position. A small incision is made in the seventh intercostal space near the midaxillary line. Naturally the site of the incision varies with the location of the pus. A flapper tube is introduced and the pus is allowed to run out. The tube is held in place by one silkworm-gut stitch. At no time have there been any disturbing symptoms caused by completely evacuating the cavity at operation. Irrigation is started in the next few days, the exact time depending on the condition of the patient and the amount and character of

*This paper was read only in part at the meeting. It will appear in full in a later issue of the JOURNAL.

the drainage. Usually on the fourth day the cavity is irrigated, the patient reclining with wound uppermost. Saline solution is introduced through the flapper tube, the measured amount determining the size of the cavity. If no coughing is produced, Dakin's solution is then used cautiously. If there is no "gassing" the cavity is then daily cleansed by thorough irrigation with Dakin's solution. This daily irrigation is not an attempt to sterilize the cavity, but is sufficient to keep thin and deodorize the discharge.

If, judged by temperature, appetite, type of discharge and general condition, it is found that the patient has not materially improved at the end of eight or ten days, and there is no acute otitis media or recurrence of pneumonic process, we conclude that we are dealing with a complicated form of suppurative pleurisy, such as multiple loculi or a markedly thickened pleura preventing complete drainage, and an exploratory thoracotomy is performed.

Under light ether or gas anesthesia, an intercostal incision is made, long enough to give proper exposure, and a rib spreader is introduced. If more exposure is required, a rib may be cut at one or both ends and telescoped. Under visual guidance, division of vicious adhesions, a partial decortication or any other procedure necessary is done, thus converting multiple loculi into a single cavity, or placing drainage where it is needed. This may appear radical surgery, but properly done it produces little shock and reduces mortality, shortens convalescence and cause no deformity.

The order of treatment in suppurative pleurisy is: first, adequate drainage; second, skilful nursing and high caloric diet; third, blood transfusion.

Only whole blood, by the Lindemann method, is given. With whole blood, accurately matched and given in proper amounts, reactions are seldom seen.

It is very difficult to make a classification of suppurative pleurisy cases, but for clinical purposes they may be divided into three groups:

1. Cases having good prognosis.
2. Cases having poor prognosis.
3. A middle group in which the prognosis is largely dependent on the kind of treatment received.

1. *Good Prognosis.* In this clinical grouping about 40 per cent of the patients come under the heading of good prognosis. The patient has inherited a healthy constitution and has been surrounded by fair conditions during health, the primary disease was promptly diagnosed and treated, the complicating suppurative pleurisy was encapsulated and, in turn, was promptly diagnosed and received proper care during its formative period. Such patients will recover if they are given adequate drainage by any of the methods advocated. The period of invalidism will be minimal. The type of organism is a minor matter. Recovery statistics in this group are very gratifying.

2. *Poor Prognosis.* Our series at Bellevue Hospital shows about 25 per cent in this group. Through the Social Service Department we have found living conditions bad, unhealthy parents, dirty unsanitary homes, underfeeding and exposure. Rickets is almost universal. Add to this background a virulent infection, the primary disease improperly diagnosed, a starvation diet, and the child sent to the hospital only when in extreme condition. Such cases, with an encapsulated suppurative pleurisy, will often do surprisingly well if given adequate drainage and plenty of food. But in a patient with a virulent infection with complicated pleural involvement, or one who has already developed complications such as acute otitis media, or pneumonia of the opposite lung, the prognosis is universally bad regardless of the type of operative procedure.

3. *Middle group* (prognosis much dependent upon surgical procedure). The remaining 35 per cent fall in this group. In this class, where the background has been only fair, the treatment of the primary disease good, but the infection virulent, the surgical treatment largely determines the ultimate outcome.

One hundred and fifty-four children's cases are here reported covering a five-year period from 1919 to 1924 inclusive. These children, ranging from infancy to twelve years of age, were admitted to Bellevue Hospital on the Children's Surgical Service. The cases were divided into age groups for a statistical study. The first or infant group includes all children under two years of age; the second from two to six years; and the third from six to twelve years. The mortality of the first or infant group, 48 cases, is 35.4 per cent; of the second group, 73 cases, is 10.9 per cent; of the third group, 33 cases, is 3.3 per cent. The mortality for the entire series of 154 cases is 16.8 per cent.

Discussion

Dr. Howard Lilienthal: It has been a great pleasure to me to hear what Dr. Bohrer had to present, inasmuch as he states that he follows the principles I have tried to teach. It has been most gratifying to see the work he has done, and particularly to note the results in a class of cases as difficult as anyone is likely to encounter, those of the children in the service at Bellevue Hospital.

I would like to point out one or two things of interest in connection with this subject. In the first place, I am delighted to see that Dr. Bohrer is making use of free thoracic exploration and that he has had such good results with it. Most surgeons are afraid of it. But if they have an ocular demonstration of the procedure and come to see the patient next day they will learn that it is not as shocking as it seems. Dr. Bohrer has wisely used transfusion in many of these children and that is also a very good procedure. This "dangerous operation" shows only a mortality of 4 per cent. The combined operations show 16.8 per cent. People do not ordinarily realize, until they have done surgery for a long time, that empyema in a child is a very dangerous disease and that in those that apparently get well a secondary operation often has to be performed, with a very considerable late death rate.

Another point in addition to those mentioned by Dr. Bohrer is that in children it is easier to reach all parts of the chest with a comparatively small opening than it is in adults. In addition to the high caloric diet, I believe in "anti-prohibition" in the treatment of these cases. I consider the use of alcohol to be of the greatest importance, in fact sometimes a necessity. These children are losing albuminous material in large quantities and we must replace it with food. They are also wasting and by administering alcohol we produce the necessary heat. It is a valuable adjunct to the feeding. As to exposure of the child to cold, we must remember the proportion of the body surface to the entire bulk of the individual. An elephant has far less surface exposure to air relatively to bulk and weight, than a mouse. Children suffer more from exposure because of this ratio.

Dr. Bohrer has, avoided the rule of thumb method in treating his patients. Empyema is a disease which has to do not only with the presence of pus but with a protean, gross pathological anatomy and we have to know the case we are working with and handle it individually.

As to the flapper tube, I think I can make a good suggestion. Instead of using a glove finger, use the rolled up finger cot. This is very thin and will act much better as a valve, especially in a child. I tie it to the end of the tube and slit the closed end with scissors. With every expiration and cough air is forced out from the chest and we have gained in expansion of the lung. I do not wash out the chest with Dakin's fluid unless the case requires further operation with a fairly large thoracotomy. With the use of the flapper tube, no matter how thick and foul the pus, provided there is no hole in the lung, it will become thinner and serous and the lung will expand to the chest wall, when the tube may be removed.

There is one point where I think I shall have to differ with Dr. Bohrer and that is in the explanation of lung motion. On inspiration with the chest open the lung contracts and on expiration it expands. This is proved when the patient coughs; then the lung bulges and pus is forced out of the thoracotomy wound.

Dr. R. E. Stetson: I think Dr. Bohrer has been most fair in giving credit to the transfusions that were done in these cases. It is hardly possible, without seeing them, to appreciate the condition of some of these children when they are brought in to the hospital. It was quite evident to all of us that certain patients would have died had it not been for transfusion. I agree with Dr. Bohrer's statements of the importance, not only of the technique but also of the study of the amounts of and intervals between transfusions. Anything that interferes

with the pulmonary circulation offers an obstacle to the success of the transfusions. It is only through experience that one can learn the dosage best for the particular case. We consider transfusion almost a routine. It has been most gratifying to feel we have played some part in keeping down the mortality statistics.

Dr. Alfred S. Taylor: I should like to express my gratification at this presentation. There are certain features that make their special appeal to me. In the treatment of these cases brains were applied to the problems presented by each individual child and the fact was not lost sight of that each case presented a physiological entity in the course of a serious disease, and attention was not focussed merely on the surgical lesion.

It is refreshing to listen to a paper, the conclusions of which are based upon the thoughtful consideration of a large group of personal cases, instead of rambling through the literature of the past century, in the modern style. With Dr. Bohrer's conclusions there can be no disagreement in essentials.

Dr. Thomas H. Russell: I have had a number of these cases at Gouverneur Hospital during the past five years and have found that they have done very much better without irrigation of any kind than with it. I have attributed the success that I have had in empyema cases to the fact that I have been making much lower drainage, in the dependent part of the chest, after removing a piece of the ninth rib in the posterior axillary line. Since I have been using this method of drainage I have not had to reoperate a single case.

Dr. Louis Sachs: I would like to ask Dr. Bohrer whether he has had any experience with closed drainage. I tried this on a case too sick for operation and the child got well.

Dr. Edwin G. Ramsdell: I would ask Dr. Bohrer the age of the youngest child in his series. I do so because of a case seen recently at the Fifth Avenue Hospital. A baby three weeks old began with symptoms of toxemia and high fever, dating almost from birth. A diagnosis of empyema was made after a roentgen-ray examination, which revealed a massive collection of fluid in the left chest. In spite of a simple thoracotomy, this infant died in a few days of progressive toxemia and prostration.

In regard to the "flapper" drainage tube, I would like to ask Dr. Bohrer or Dr. Lilienthal if they happen to know where this idea originated. I first saw it used in 1919 in France by Dr. Delagenière at LeMans. He told me he had been using this type of drainage, which he called "drainage Soupape" for several years before the War. I judged from his remarks that it was original with him. He ties a finger cot over the end of a plain rubber tube, which is inserted through a small wound in the chest wall. The skin is sutured about the top with one silkworm-gut suture. In this way no air can enter the chest. With every expiration, the pus spurts through the end of the tube and with inspiration, the little finger cot collapses over the end of the tube preventing the sucking-in of air. As the fluid level is reduced, the lung is bound to expand and collapse of the lung is in this way prevented.

I have used this method with a great deal of satisfaction since 1919 and am interested to find that Dr. Bohrer indorses it after so extensive an experience.

Dr. Howard Lilienthal: The principle is an ancient one. I do not claim originality except in the use of the very thin finger cot instead of the rubber glove. As a matter of fact, the tube can remain in place for a long time if put in with a cannula. If there is leakage I put in a stitch to hold it. I did not wish to be understood as saying I never used irrigation; I always do so in open cases, but never in closed ones.

Dr. Frederic W. Bancroft: Has Dr. Bohrer noticed any poor results from long waiting in post-pneumonic empyema cases? During the War the treatment was evolved of waiting in streptococcus cases until the mediastinum was stabilized and frank pus was aspirated This undoubtedly was a marked advance in our treatment of empyema. At the present time, however, I feel that perhaps the pendulum has swung too far and operation is often delayed until great thickening of the pleura has resulted. When the pleura has become too thick and rigid, obliteration of the cavity by expansion of the lungs becomes much more difficult.

Dr. Bohrer (closing): Dr. Lilienthal brought out a very interesting point regarding the feeding of suppurative pleurisy cases. In dealing with children I had not thought of using alcohol, but I believe it would be useful and at times very valuable. The feeding problem has been the hardest one to solve. At the present time we have in the wards a fifteen-months-old baby who refused to take food and the only way to keep him alive was to provide a

special nurse who fed him small quantities every fifteen minutes. We tried gavaging this patient but he regurgitated even when given as small an amount as an ounce at a time. This was due to his stomach having contracted earlier in his illness. He is making a good recovery.

The suggestion of the finger cot on the flapper tube interested me. I tried various rubber flappers, such as a roll of rubber dam, a condom, and finger cot, but the one that proved most usable was a glove finger that has been sterilized and used many times. It is soft and supple and not friable.

When I first used a flapper tube I thought it was original. But I soon learned that others were using a similar device. It reminds me of a speech made by Dr. Joseph Bryant on the subject of "The Old and The New" in which he showed that many "original" present-day devices had been used years ago and forgotten.

As regards irrigation, that is a matter to be decided in individual cases. One must use judgment in irrigating. The decision depends on the type of discharge. The tendency is to watch the case and avoid putting anything in the chest, unless absolutely necessary.

The objection to using the ninth space is that the diaphragm becomes elevated as the chest condition improves and tends to block the opening. I use the seventh space in order to insure free drainage of this portion of the pleural cavity, as there is less expansion of the lung at this point.

As to closed drainage, I did some work with this in 1920 and was disappointed in the results. We had many empyema cases that year and I divided them into two groups, the open method and the closed method; I found the mortality in the closed method group was higher. It has therefore not appeared to me to be a satisfactory way of draining.

As regards age, the youngest child in this series was just about two weeks old on admission. How it could develop pneumonia and empyema at that time of life I do not know, but it did. I operated when it was three weeks old and found a small encysted cavity; the patient recovered.

I cannot answer Dr. Bancroft's question regarding the thickening of the pleura. The exact time to operate, so as not to prolong the period of waiting too much, has been a great question with me also. This is exceedingly important, as the thickness of the pleura is increased if the time before operating is too prolonged. Judgment is necessary to determine that point.

THE CONTROL OF HEMORRHAGE FOLLOWING NEPHROTOMY FOR THE REMOVAL OF CALCULI

DOUGAL BISSELL, M.D.

(*Abstract*)

Ureterotomy for the removal of renal calculi has certain advantages, but should the ureteral incision fail to heal, one is driven to the necessity of removing the kidney.

In cases of renal calculi ureteropyelolithotomy has been resorted to by me from 1901 to 1916. In the latter year there came under my care a patient with stone of considerable size in the renal pelvis. This was removed through an opening made in the upper ureter, but the delivery of the stone caused an irregular extension of the incision, difficult to repair, which became infected, with resultant persistent fistula. Nephrectomy was finally necessary. This unfortunate outcome directed my attention to the development of a nephrotomy technique for the removal of renal calculi with less liability to urinary fistula, and provision for the control of renal hemorrhage. The feature of the technique pertained chiefly to the closure of the renal incision and the removable sutures encircling the kidney, which are utilized, should necessity demand it, to stop postoperative hemorrhage.

When the kidney is delivered and freed from its cellular tissue, the renal vessels are isolated and are compressed directly by a ring forceps covered with rubber. A median longitudinal incision is now made through the kidney and the calculi are removed. The kidney incision is closed by passing a cambric needle large enough to accommodate No. 0 chromicized catgut. The suture is doubled, but its free ends are not tied. The small canal made by the needle is completely filled by the double suture. The needle is passed through the kidney

substance on a plane with the cut edges of the pelvic incision and repassed on the same plane in the opposite direction so as to form a loop. The securing of this suture may be made in one or both of the following ways: (1) the needle end of the double suture, after its final emergence, is passed through the double loop on the opposite surface and tied over the convex border to the free ends; (2) the double suture is severed from the needle and one of the severed sutures is tied as a mattress suture while its companion single suture is dealt with in a similar manner, as are the double sutures in the first method. Two B. and B. tension sutures are now passed completely around the kidney, one just above the upper and the other just below the lower limits of the hilum. To prevent these sutures from losing their positions they are made to penetrate superficially the anterior and posterior surfaces of the kidney, deep enough only to secure an anchorage in the fibrous capsule. After releasing the hemostatic clamp and returning the kidney to its bed, the free ends of the silk sutures are passed through all of the tissues on one side and the other of the lumbar incision and tied in a bow-knot over a bolster of iodoformized gauze. These sutures, when tightened as necessity indicates, will insure hemostasis and anchorage of the kidney to the abdominal wall.

A case had been operated on by another surgeon in 1913 to remove three calculi from the left kidney. Part of the technique then used was the passing of a rubber drainage tube through the kidney wound into the renal pelvis for direct drainage.

Operation: A left lumbar incision was made. Great difficulty was encountered in freeing the kidney from the abdominal wall, and an extensive area of kidney surface was severely traumatized. After freeing the ureter and renal vessels from each other and their encircling cellular structure, the vessels were grasped by a rubber-covered ring forceps and the kidney was incised longitudinally. The stone was then extracted from the pelvis. A cambric needle large enough to accomodate No. 0 plain catgut and threaded with this as a double suture, ends not tied, was made to penetrate the kidney substance on a plane parallel with the cut edges of the kidney pelvis. The needle was then re-entered at a point less than 0.5 cm. from its exit and made to penetrate the kidney again on the same plane and emerge at a point 1 cm. from its original entrance. Four of these sutures were passed about 1 cm. apart. The needle end of each individual set of sutures was passed through the double loops on the opposite surface and tied to the free ends over the convex border. Two removable encircling sutures of silk were passed about the kidney, one above and one below the limits of the hilum, as described.

Postoperative History: During the first twenty-four hours a small amount of blood was found in the urine. No recurrence of bleeding was noted until the fifth day, when bleeding continued four days. The lumbar wound was dressed on the seventh day. No bleeding was discovered. On the eighth and ninth days a considerable amount was noted, also a considerable amount in the urine.

Calcium chloride, 15 grains, was then given intravenously, also calcium lactate, 5 grains, were given t.i.d. by mouth. The bleeding was checked for eighteen hours, then recurred and continued for two days in spite of the continued use of both calcium salts.

On the thirteenth day the small thin rubber drain was removed and the lower encircling tension suture sustaining the kidney was loosened and retied tightly over a fresh bolster of gauze. Bleeding at once ceased and did not recur.

It would appear that the early bleeding into the kidney pelvis was the result of the yielding of the plain catgut used to approximate the cut surface of the kidney, and therefore chromicized catgut of the same size should be substituted for it. Bleeding from the lumbar region did not occur until the eighth day, which suggests that its source was the traumatized kidney tissue of the lower pole. As calcium salts were given a fair trial, but failed to check hemorrhage permanently, and as the steadily increasing hemorrhage was immediately and permanently checked both internally and externally by tightening the silk sutures encircling the lower pole, the value of the removable and encircling sutures under these circumstances would seem demonstrated.

Discussion

Dr. Louis Carp: If the nephrotomy incision is made to one side of the midline of the kidney it will be less apt to bleed. Dr. Beer uses an excellent method to help control hemorrhage in closing a nephrotomy incision: he passes chromicized catgut mattress sutures through pieces of excised subcutaneous fat or muscle placed on either side of the nephrotomy incision. This makes possible drawing the suture tight and prevents it from cutting through the kidney substance.

Dr. Frederic W. Bancroft: Dr. Bissell has brought out some interesting points. The difficulty in nephrotomy has always been the hemorrhage. Kelly demonstrated the value of incising the kidney 1 cm. posterior to the median line; also he advised cutting by inserting a heavy wire deep in the parenchyma of the kidney and drawing it upward so that the vessels are pushed aside, instead of the method usually pursued of cutting with a sharp knife from the surface toward the pelvis. Dr. Bissell's plan of having stay sutures which may be applied as a tourniquet should late hemorrhage occur is undoubtedly of great value.

Dr. Bissell (closing): It was stated in my paper that plain catgut was used to approximate the cut surfaces of the kidney but since the internal bleeding which occurred on the fifth day, as evidenced by blood in the urine, was thought due to the plain catgut giving away early, I considered that chromicized catgut should be used instead. External bleeding, as evidenced by the escape of blood from the lumbar incision, arose from the extensive traumatized area on the covex border, which was found firmly adherent to the abdominal wall. The silk sustaining suture, when tightened over the lower pole, brought the traumatized surface up firmly against the abdominal wall and prevented hemorrhage from that source at the same time checking internal hemorrhage which also must have arisen from the lower pole.

PRESENTATION OF CASES

MULTIPLE OPERATIONS AND INTESTINAL ANASTOMOSES

LEO BUERGER, M.D.

This is an exceedingly interesting, but not very gratifying, case of multiple surgical interventions in a woman of twenty-nine years who has undergone fourteen major operations during the last fifteen years. Of these, two were operations on the kidneys, twelve were laparotomies. She has had two gastroenterostomies and five enteroenterostomies. She is still far from being relieved of her symptoms, and it is with the hope of obtaining enlightenment as to what should be done in her case or in similar cases, that I am presenting, in as brief a manner as possible, the maze of technical procedures that her suffering has led other surgeons and myself to undertake.

She is now, and has been for years, the victim of an intense and extensive intraperitoneal adhesive process, with chronic gastrointestinal obstruction; and whatever its origin may have been, it has resulted and is still resulting in the necessity for repeated operative exclusion of more and more intestinal territory. Whither it will lead, only the future can tell. Here, in brief, is her story:

At the age of ten, she had dysentery which lasted about four weeks, followed by constipation, pyrosis, nausea and occasional vomiting after meals (1908, in Europe). Because of constipation, indefinite gastric symptoms and indefinite abdominal pains, especially referable to the left lower abdomen, she was admitted to the Beth Israel Hospital, New York, December 1912, where an exploratory operation was performed (Dr. Bandler).

Operation 1. A cyst of the left ovary was found. The left broad ligament was shortened, the cyst was punctured and the appendix was removed.

In July, 1913 (Mt. Sinai Hospital) the case was diagnosticated as one of juvenile tabes, paresis and hysteria.

The symptoms subsided for a very short time, but pain in the right lower abdomen soon developed, followed by constipation and gastric symptoms. A new manifestation was pain in the right lumbar region with urinary frequency, nocturia and hematuria. Roentgenograms were negative. Because of the aforementioned symptoms, she was admitted to the Beth Israel Hospital in December, 1915.

Operation 2 was performed by Dr. Goodman. The right kidney, found enlarged, was explored. There were no calculi. Decapsulation was carried out. This operation seemed to relieve the urologic symptoms, but the abdominal

symptoms persisted. Because of these a third operation was performed.

Operation 3 was done at the Beth Israel Hospital, January 28, 1916 (Dr. Goodman). The findings were adhesions in the region of the cecum, binding this to several loops of small intestine and omentum. There were several large peritoneal glands, the nature of the enlargement was not determined. The adhesions were liberated.

Two weeks after the operation a sinus developed, which was suspected of being an "intestinal fistula." These are the data obtainable from the hospital records.

Operation 4. At the Beth Israel Hospital, February, 1916 (Dr. Isaacs), the fistulous tract was excised and found to end blindly. The pathological report was chronic inflammation.

In July, 1916, the patient was at the Mt. Sinai Hospital, where Dr. Beer diagnosed the case as one of abdominal adhesions, and tabes dorsalis, but no operation was performed.

In 1917, she complained of left lumbar and diffuse abdominal pain, and gave a history of having passed several calculi. Roentgen-ray examination of the urinary tract (Beth Israel Hospital) was negative. Cystoscopy, however, revealed a "stricture" in the right ureter, 6 inches from its orifice in the bladder. The left kidney was catheterized and found negative. At about this time the lower right abdominal wound opened, discharging purulent fluid. The abdominal and gastric symptoms, as well as the pain in the left lumbar region were present as before. In addition, dysuria, urinary frequency, nausea and vomiting were among her complaints.

With these symptoms the patient came to me January 22, 1918. Upon cystoscopy no flow from the right kidney could be obtained. The left kidney was catheterized and found negative. Pyeloureterography demonstrated marked tortuosity of the right ureter.

Operation 5. At the Polyclinic Hospital, March 9, 1918, I dissected out the abdominal sinus and the patient was discharged with the wound healed.

The pain in the left lumbar region persisted until May 10, 1918, when at cystoscopy retention was found in the left kidney. The pyelogram revealed dilatation of the extrarenal pelvis. In June, 1918, the case was again diagnosticated (Mt. Sinai Hospital) as one of tabes dorsalis and congenital lues. The Wassermann reaction was negative.

Operation 6. Because of the persistence of symptoms in the left kidney and the apparent excessive suffering of the patient, the sixth operation was performed by me at the Polyclinic Hospital, October 5, 1918. Findings were slight hydronephrosis and angulation of the ureter; operation, nephropexy and decapsulation.

Operation 7. Anorexia, vomiting and constipation as well as epigastric distress persisted, and the patient submitted to operation 7 (Mt. Sinai Hospital), January 6, 1919. An exploratory laparotomy was done by me and massive adhesions were found throughout, especially about the cecum and small intestine; these were liberated.

The gastric symptoms and persistent vomiting finally became so severe, that the patient was readmitted for operation.

Operation 8 at the French Hospital, June 13, 1919. It was evident that evacuation of the stomach was impossible because of angulation of the duodenum, pylorus and first part of the jejunum, wherefor a posterior gastroenterostomy was performed (by me). The adhesions were liberated, and the patient was discharged considerably improved, but complaining of slight epigastric distress. In October, 1919, she gave a history of pain in the left lumbar region and epigastrium, and operation seemed indicated.

Operation 9. Laparotomy for postoperative adhesions (Beth David Hospital, October 30, 1919). The transverse and ascending colon were markedly distended, but there was no apparent obstruction in the region of the splenic flexure or descending colon. The stomach was free and bound down by surprisingly few adhesions. The stoma of the gastroenterostomy was patent and admitted two fingers very readily; there was no kinking of the jejunum, but there were extensive dense adhesions in the ileocecal region and kinking of the ileum and cecum at the ileocecal junction, the cecum apparently retroperitoneal. The omentum and inflammatory bands were adherent to an infantile uterus. The adhesions were freed, some omentum was resected, and the normal anatomical relations of the ileum, cecum and ascending colon were established. The free edge of the visceral peritoneum was sutured to the cecum and ascending colon. The trans-

verse colon, which was also rather redundant, was placed over the small intestine.

Operation 10. In November, 1919, the symptoms of intestinal obstruction again manifested themselves and operation was performed December 16, 1919 (at the Beth David Hospital by me), enteroenterostomy for adhesions and obstruction.

In April, 1920, she gave a history of vomiting and obstructive symptoms, but was able to retain some nourishment and the bowels responded to enemas. From then on the symptoms became more marked.

Operation 11 was undertaken January 12, 1921 (Beth David Hospital). I performed an anterior gastroenterostomy and enteroenterostomy for intestinal obstruction. The old gastroenterostomy and enteroenterostomy stomas were patent; several loops of small intestine adhered to the anterior abdominal wall and there were many kinks and adhesions between loops of gut. (A loop of gut distal to the enteroenteric stoma of the previous operation was dilated.) A loop was brought up and anastomosed to the anterior surface of the stomach. The gastroenterostomy was then followed by an enteroenterostomy and anastomosis of the dilated loop of gut with its collapsed portion. She was discharged February 2, 1922, much improved.

In November, 1922, symptoms such as previously complained of were diagnosed (Dr. Held) as being "due to adhesions of the stomach and possibly to gastrojejunal ulcer."

Operation 12 was performed ten months later at the Beth David Hospital (by me). An enteroenterostomy was carried out to relieve intestinal obstruction. The stomach was found dilated; the anterior and posterior gastroenteric stomas were wide open, the enteroenteric stomas well open, and the upper loops of the jejunum distended. At one point there was a sharp kink due to dense adhesions. The adhesions were scant in the upper abdomen, but more profuse in the lower abdomen. A lateral anastomosis was done between a loop of distended and an adjoining loop of collapsed gut. On December 31, 1922, she was discharged in good condition, vomiting being absent.

Operation 13 became necessary on January 16, 1924 (at the Beth David Hospital). A sharp kink was discovered in a loop of ileum, one limb being collapsed, the other distended. A lateral enteroenterostomy was done. On January 25, 1924, it was noted that the abdomen was distended and at times flat. Vomiting finally ceased and the patient was well for nine months after the operation.

Operation 14. Gradually increasing severity of symptoms, distention of the abdomen and cramps in the abdomen led to the fourteenth operation which was performed by me at the Beth David Hospital April 23, 1926. There were found dilated and collapsed loops of small intestine with angulation due to adhesions, Enteroanastomosis was carried out.

The patient remained comfortable after this operation for a period of several months. Laterally the abdomen is again beginning to protrude, although there is not the drum-like and tense belly characteristic of obstruction.

If we summarize the operations there were: first, the initial exploratory operation; second, the operations on the kidneys; third, the operation for the fistula; and fourth, the operations for gastrointestinal obstruction.

We have no data on the existence of the adhesions at the first operation. The first of the kidney operations on the right kidney did not seem to be any more essential than the second one done on the left. The history of passing stones is at least doubtful. Evidences of adhesions and peritonitis seemed to exist already in 1916, when the abdomen was explored and a sinus developed. Then two operations were done for this (the second one by me), resulting in closure of the sinus. But little of the peritoneal cavity was opened at that time, so that the extent of the adhesive peritonitis was not determined. I have performed, in all, ten operations on this girl, nine of which were laparotomies.

I must confess that the operation on the left kidney, in spite of the slight hydronephrosis and angulation of the ureter does not seem to have been altogether warranted, since the left-sided pain may have been referred from the intra-abdominal condition.

Eight laparotomies have been done by me since 1919, in a period of eight years. Recovery after each has been good, but not complete. Obstruction develops gradually, and, today, twenty-two months since the latest operation, she has abdominal distention and more frequent vomiting, and bids fair to become a candidate for additional surgical onslaughts.

(*No discussion*)

COMPOUND FRACTURE OF THE TIBIA WITH OPEN KNEE JOINT

JOHN H. GARLOCK, M.D.

T. M., boy, aged five years, was struck by a truck, one wheel of which passed over his right leg. He was immediately admitted to the Second Surgical Division of the New York Hospital, March 22, 1926. He was in moderate shock. Below the inner side of the right knee was an irregularly shaped transverse laceration opening into the joint. The soft parts showed considerable crushing. There was another irregular laceration over the middle of the tibia with crushing of the skin and muscles. The periosteum of the tibia was stripped for a distance of 4 inches. Operation was performed soon after admission. The knee wound was thoroughly scrubbed and irrigated with saline solution followed by ether. Iodine was applied to the skin and subcutaneous tissues, care being taken not to allow any of it to enter the joint. The wound was thoroughly débrided and the capsule was closed with chromicized catgut. The skin was sutured with silkworm-gut without drainage. The leg wound was treated in a similar manner. A longitudinal incision was made and a large hematoma in the muscle planes was evacuated. All traumatized muscle was excised. The ends of the fractured tibia were removed with rongeurs. The wound was then again irrigated. The fractured ends were fashioned into a mortise arrangement and held in this position by a strand of kangaroo tendon placed about the tibia. The fascia was then sutured with chromicized catgut and the skin was closed without drainage, using silkworm gut. A plaster cast was then applied, extending from mid-thigh to toes.

The postoperative course was uneventful except for a sharp rise in temperature to 103° F. on the second day. It rapidly came down to normal. A window was cut in the cast and, on the sixth postoperative day, it was noted that the skin edges of the leg wound showed some necrosis. The knee wound had healed by first intention. The necrotic skin edges were excised and this wound then rapidly healed. Three weeks after operation, the cast was removed and it was found that there was soft callus at the site of fracture with slight posterior angulation. A posterior molded splint was applied, correcting this angulation and placing the knee at 45° flexion. Three weeks later, a new splint was applied with the knee in the extended position. The patient was discharged from the hospital, two months after admission, walking on the plaster splint. He received no physical therapy.

At the present time, there is normal motion in the knee joint, there is no shortening of the leg, and the patient walks without any limp.

(*No discussion*)

COMPOUND FRACTURE OF THE RIGHT TIBIA WITH OPEN KNEE AND ANKLE JOINTS. LATE RESULTS

JOHN H. GARLOCK, M.D.

G. K., male, aged thirty-six years, was shown before the Section of Surgery at the May, 1926, meeting, as an early result. It was then seven weeks after operation. At that time, there was complete extension at the knee, and flexion to a right angle with about 50 per cent impairment in the ankle joint. The patient was then able to get about with the aid of crutches.

On February 18, 1926, his right leg was caught in the revolving blades of a washing machine which he was repairing. He was admitted to the Second Surgical Division of the New York Hospital, service of Dr. Pool, and operated upon immediately. There were found multiple lacerations of the leg and a transverse laceration at the inner aspect of the knee joint which was open. The internal tuberosity of the tibia had been removed in an oblique manner by the accident, along with about two-thirds of the internal meniscus. There was another laceration at the inner aspect of the ankle, exposing the joint proper. The internal malleolus was missing. There were numerous lacerations of the leg exposing the tibia for a distance of three or four inches. After thorough preparation of the wounds with prolonged irrigation, scrubbing, flushing with ether, etc., a thorough débridement was done. The capsule of the knee joint was repaired with chromicized catgut, and all the wounds were closed without drainage. Active motion was started on the fourth postoperative day. The patient was allowed out of bed on the eighteenth postoperative day, and was discharged a month after operation to the out-

patient department, where he received a prolonged course of baking and massage.

At the present time, all the wounds are healed, there is normal motion in the ankle and knee joints, which are perfectly stable, and the patient is able to get about without the aid of any support.

(*No discussion*)

COMPOUND FRACTURE OF THE TIBIA. EARLY PEDICLE SKIN GRAFT

JOHN H. GARLOCK, M.D.

P. McA., male, aged fifty-one years, on July 22, 1925, while getting off a tug, caught his right leg between the bow and a post on the dock, receiving a crushing injury. He was admitted to the New York Hospital in considerable shock. At operation, a few hours later, after he had come out of his shock, there was found a 2-inch transverse, lacerated wound along the inner side of the right leg at the junction of the midle and lower thirds, with two similar wounds anteriorly, and one on the outer side. The skin, for a distance of 6 inches around this area, was obviously not viable. After exposure, it was found that all the muscle and subcutaneous tissues along the inner and posterior aspects, were severely crushed. The posterior tibial vessels were divided, but the posterior tibial nerve was intact. The tibia was fractured in a spiral manner with long anterior and posterior fragments. The anterior tibial vessels appeared to be intact.

The procedure consisted in a complete débridement of all the soft parts, including the traumatized skin. This left a gap 5 inches in width, extending around the inner and posterior aspect of the leg. The tendo Achillis was intact. A strand of kangaroo tendon was placed around the fractured site. The wound was left wide open and a posterior molded splint was applied. A note made at that time read: "It is questionable whether the circulation of the foot will remain good, but with the apparent absence of injury to the anterior tibial vessels, it is thought best to give the patient a chance to reestablish the circulation in the part."

The convalescence was relatively uneventful. The wound was dakinized. Circulation of the foot remained good. The temperature never went above 101° F. Three weeks later, the cast was removed. It was found that union was fairly firm. The wound was clean. On September 1, about five weeks after operation, it was found that union was firm, and alignment of the fragments was good. The wound consisted of a granulating area along the anterior and internal aspect of the leg, measuring 6.5 cm. by 12 cm. It was decided to cover the raw area with a pedicle skin flap from the opposite leg. On September 8, a tubular graft was made on a posterior aspect of the left leg. This measured 13 cm. by 7.5 cm. The skin edges on the lateral sides were undermined and brought together beneath the tubular graft. To relieve tension, multiple scarifications were made on either side. Circulation of the graft remained intact. Nine days later, a rubber band was tied around the upper end of the graft for fifteen minutes. This was repeated on two successive days, increasing the time of compression. Twelve days after the first operation, the second stage was performed. The area to be covered was curetted and the edges were freshened and undermined. The upper end of the pedicle was divided transversely. The line of suture on the graft was excised and the graft was "cored" out. It was found to measure 12 cm. by 7 cm. In order to guard against necrosis of the distal end, the terminal ¾ inch was excised. The left leg was then placed in front of the right leg and the graft sutured into place for three-quarters of its length. A plaster cast was applied from the toes to mid-thigh. Daily dressings were done through a window in the cast. The graft healed by first intention. Eleven days later, the third stage was done. It was found that the area from which the graft had been taken on the back of the left leg presented a granulating wound where the skin edges had separated. There still remained two inches of wound to be covered. The base of the graft was divided and was sutured to the remaining raw area. The granulating area in the back of the left leg was covered with Thiersch grafts. All wounds healed, and the patient was discharged October 19, 1925, three months after the receipt of the injury. He received a course of physical therapy in the outpatient department.

At the present time, one year and eight months after operation, examination shows that the fracture is united, there is no shortening, motion in the ankle joint is practically normal, and there is no circulatory disturbance

of the foot. The graft is flat, well padded, and shows a return of sensation.

(*Discussed with the next case*)

COMPOUND FRACTURE OF THE TIBIA. LATE PEDICLE SKIN GRAFT FOR ADHERENT TENDER SCAR

JOHN H. GARLOCK, M.D.

D. U., boy, aged four years, was first admitted to the Second Surgical Division of the New York Hospital on September 12, 1925, with a history that half an hour before he was run over by a taxicab, two wheels passing over his left leg. He had a compound fracture of the left tibia and fibula with avulsion of the skin over a distance measuring 2 square inches. Soon after admission a débridement was performed and it was found that there was a transverse fracture of the tibia and fibula. The wound was left wide open in order to be dakinized. A posterior plaster splint was applied. On the third day after operation, examination showed that the fragments had slipped. The wound was clean. The fragments were readjusted and another plaster splint was applied. Fragments again slipped. The attempt was made to apply traction by overhead extension and later by using a Thomas splint with a Sinclair skate. This was unsuccessful because we were unable to control the patient. On September 24, 1925, twelve days after the original operation, the patient was taken to the operating room and the wound was found to be clean. The fragments were notched and a kangaroo tendon suture was placed around the bone. A plaster cast was applied, incorporating a metal band posteriorly. The wound was dakinized, healing slowly. The boy was discharged January 2, 1926, without shortening, but with slight external bowing, and wearing a brace. The wound had not yet healed.

He was admitted again to the hospital six weeks later. There was an irregular granulating area, measuring 6 cm. by 10 cm., over the front of the tibia. Bony union was firm. The wound was dressed daily and was practically healed when the patient was discharged on March 12.

The patient was readmitted to New York Hospital on October 11, 1926, with a thin scar over the front of the left tibia adherent to the bone. The patient's mother stated that on the slightest injury, this scar broke open and healed very slowly. It was decided to excise the scar and cover the raw area with a pedicle flap from the opposite leg. On October 14, a tubular graft was prepared on the back of the right leg, in such a fashion that the length was to the width as three is to one. The skin edges remaining, after the flap was lifted, were undermined and brought together with silkworm gut sutures beneath the flap which was fashioned into a tube with skin surface outward. The subcutaneous fat was included in the graft. Seven days later, a rubber band was tied around the upper end for two hours. On the following day, it was applied for four hours. On October 23, nine days later, a second stage of the operation was done. The scar over the front of the left tibia was excised. The upper extremity of the tube flap was divided transversely. The right leg was placed in front of the left, the tube was opened, and the excess fat was cored out. The flap was then sutured into the deficiency over the front of the left tibia for two-thirds of its length, beginning at the lower end. A circular plaster cast was then applied, holding the two extremities in their new position. Through a window cut in the cast, dressings were performed daily. The third stage was done twelve days later. At this time, the distal end of the flap was cut away from its base and the remaining raw area over the front of the left tibia was covered by the remainder of the flap. The flap healed by first intention and the patient was discharged from the hospital on November 19.

At the present time, there is no shortening, and over the front of the tibia the skin is not adherent and withstands ordinary trauma.

Discussion

Dr. Morris K. Smith: I would ask Dr. Garlock if he had much trouble in the after-care of the patient. I am interested in this case because I once did a pedicle grafting in a case of a large leg ulcer, taking the graft from the front of the thigh and placing the ulcerated leg across the opposite knee. The graft took satisfactorily but I always felt that if the patient had not been very cooperative and willing to put up with considerable discomfort the same result would not have been accomplished.

Dr. Howard Lilienthal: I note that in all these cases Dr. Garlock seems to have believed in the advantage of complete débridement, so frequently brought out during the late War, and I wonder whether his subsequent proce-

dures would have been possible without it. I think the value of this treatment is very well worth mentioning.

Dr. John V. Bohrer: I would ask Dr. Garlock how he closed the knee joint. Did he have enough capsule, or was the defect filled in with soft tissue?

Dr. Frederic W. Bancroft: I have seen a similar condition following osteomyelitis where the primary incision was placed over the crest of the tibia. The result was a thin epithelization attached closely to the bone, which would bleed on any trauma. In this case it was possible to excise the scar and undermine the lateral surface of the skin and fat so that skin and fascia could be sutured over the defect. I wonder if in Dr. Garlock's last case he could not have followed a similar procedure.

Dr. Garlock (closing): In answer to Dr. Smith, I can say that no difficulty was encountered with either of these patients, from the standpoint of comfort. The leg from which the skin graft was taken, was separated from the opposite leg by the interposition of sufficient padding. It was not a question of holding one leg away from the other, but rather of having one rest directly upon the other.

As regards Dr. Bohrer's question, relative to the capsule of the joint, there was some tension, but by the use of mattress sutures I was able to close the joint completely.

In answer to Dr. Bancroft, we considered the procedure he suggested, but at the time of operation, we were glad we had decided upon a skin flap, because an attempt was made to undermine the skin edges to determine the amount of tension necessary to close the defect without the graft, and it was found that a gap of about one-half inch would still remain.

Dr. Lilienthal's remarks on débridement are important. The object in showing these cases was to illustrate primarily, the principle of débridement as applied to injuries in civil life. On the Second Surgical Division of the New York Hospital, we have a tendency more and more, to suture these compound fractures and joint injuries without drainage, after a complete débridement. We feel that the preliminary preparation of the skin and wound is just as important as the débridement itself. This preliminary procedure consists of thorough scrubbing with soap and water, followed by a prolonged irrigation with saline solution, drying, benzine, thorough flushing with ether, and then thorough application of iodine. In injuries involving synovial membranes, we are careful not to have the iodine come in contact with these structures and in the majority of the cases we close them without drainage.

ARTHROLITH OF UNUSUAL ORIGIN IN THE KNEE JOINT

JOHN H. GARLOCK, M.D.

M. D., male, aged seventeen years, was first admitted to the Second Surgical Division of the New York Hospital September 29, 1926. He complained of inability to extend the right knee. One month previously, while playing football, he wrenched this joint. For several days following this injury, the knee was swollen and painful. When the swelling had subsided, the patient found that he was unable to extend his knee completely. This disability persisted up to the day of admission to the hospital. Except for the few days following the injury, he was able to walk about without difficulty and without pain.

The entire knee was swollen and there was clinical evidence of fluid within the joint. Complete extension lacked 20°. Flexion was impaired about 10 per cent. On motion, a distinct click was felt within the joint. The lateral ligaments apparently were intact. There was distinct tenderness over the internal meniscus. Roentgen-ray examination showed a calcified foreign body in the anterior compartment of the knee.

Operation was performed September 30, 1926. A long mediolateral incision was made. It was found necessary to divide some of the fibers of the vastus internus muscle. The deep fascia and the capsule of the joint were divided in the line of incision. With the patella displaced laterally, and the knee flexed, it was possible to obtain an excellent view of the anterior compartment of the joint. It was then seen that on the inferior surface of the internal condyle was a cup-shaped depression, to the posterior rim of which was attached an irregular piece of cartilage and bone measuring 2 cm. by 3 cm. by 3.5 cm. This hung down between the tibia and femur in the region of the crucial ligaments. It was evident that the patient had sustained a fracture of the cartilage of the lower end of the femur and the broken-off fragments formed the foreign body which had been visible in the roentgenogram.

The joint contained a moderate amount of serous fluid. The synovial membrane was reddened and somewhat thickened. The fragment was removed, and the joint was flushed with ether. The capsule was then closed with interrupted catgut sutures. The vastus internus and fascia were sutured and the skin was closed with silkworm gut. Convalescence was smooth. Motion was started on the fourth postoperative day. The patient was allowed out of bed on the twelfth postoperative day. He was discharged from the hospital October 17, seventeen days after operation.

At present, four and a half months after operation, there is normal motion in the knee joint and the patient is able to get about without any difficulty.

(No discussion)

[SURGICAL SUGGESTIONS]

AFTER tapping a hydrocele palpate the testis and epididymis to exclude neoplasm.

THE so-called sarcoma of the testicle is usually a carcinoma, although true sarcomata are occasionally encountered. The myeloid, embryonal carcinoma, also called seminoma, while definitely malignant, is cured by simple orchidectomy in about 20 per cent of the cases; while abdominal metastases appear to respond to roentgen therapy.

TRANSACTIONS OF THE
SECTION OF GENITO-URINARY SURGERY
NEW YORK ACADEMY OF MEDICINE

Meeting of February, 16, 1927

THE CHAIRMAN, DR. FREDERICK T. LAU, PRESIDING

COMMISSURAL PROSTATIC HYPERTROPHY

With Lantern Slide Demonstration

Not prepared for publication

ALEXANDER RANDALL, M.D.

PHILADELPHIA

(by invitation)

A DISCUSSION was presented of the origin and location of prostatic hypertrophy, citing the works of Tandler and Zuckerkandl, Albarran and Motz, Motz and Perearneau, Lowsley and others, pointing out that there had been a tendency to dogmatize that the hypertrophying prostate consistently had its origin of growth in only one location and that the above authors disagreed as to this location.

From a personal series of 1218 autopsies studied, conclusions had been drawn that it was impossible to correlate the findings with the idea that hypertrophy invariably originated in or at one fixed area. Hypertrophy may originate in any lobe of the prostate with the exception of the true posterior lobe. If such were the case, the findings from this autopsy series could not help but give definite types of hypertrophy according to its origin. In other words, one should find individual specimens illustrating lateral lobe hypertrophy, hypertrophy in the posterior commissural glandular tissue, hypertrophy in the subcervical gland of Albarran, or combinations of any or all of these. Lateral lobe hypertrophy had been always bilateral, in Dr. Randall's experience, though at times one lobe had acquired greater growth than the other: he had found specimens in which middle lobe hypertrophy was present without lateral lobe enlargement. Further, this middle lobe hypertrophy partook of a different contour according to whether the origin was in the posterior commissural tissue or in the subcervical gland of Albarran. In other words, there are two gland elements anatomically present in the midline posteriorly, either of which may undergo hypertrophy independently of the other, or independently of lateral lobe growth, and they present a picture allowing of their recognition preoperatively by the cystoscope, or at the operating table. The differential diagnosis between these types was described according to the differences cystoscopically as well as by rectal examination.

There are differences of surgical handling of these cases according to the type of hypertrophy present. Preoperative recognition should alter the surgical approach in order to cause the minimal amount of damage, allow of a clean enucleation and minimize the likelihood of postoperative bleeding. These factors likewise could not but influence the completeness and permanency of cure, and decrease a definite postoperative morbidity which has so regularly followed prostatectomy.

In the suprapubic operation (*a*) where only bilateral hypertrophy is present, each lobe should be separately enucleated; (*b*) where there is hypertrophy in the lateral lobes and also in the posterior commissure, enucleation starting about one lobe should follow the line of the false capsule under the posterior commissure and across the mid-

line and the apex of the trigone, and thence directly into the line of cleavage and about the opposite lateral lobe, the hypertrophic tissue to be thus removed in one mass; (*c*) where there is hypertrophy of the subcervical glands, it being recognized that such lie without the normal prostatic capsule and covered only by mucous membrane, such a lobe could be immediately pinched off from its pedicle without further manipulation.

In perineal prostatectomy the same rules hold true in regard to separate or total adenectomy according to whether there is hypertrophy only in the lateral lobes, or in the lateral lobes and the posterior commissure. When the operation is by the perineal route, one should not fail to look for, recognize, and remove a coexisting subcervical hypertrophy, remembering that it would not be removed from within the capsule and ofttimes lies as an intravesical projection free of any attachment to other hypertrophied gland tissue.

As the normal histology presents two masses of gland tissue lying in the midline, and presenting so-called middle lobes when hypertrophied, but having separate origin and separate anatomical encapsulation and a differing surgical significance, we should in the future eschew the use of the term middle lobe and speak of such growths as arising either from hypertrophy of the posterior prostatic commissure or from hypertrophy of the subcervical gland.

Discussion

Dr. Edwin Beer: It is always interesting to hear Dr. Randall for he has always something new to say and usually something convincing. Whether tonight is the exception to the rule, I do not know. I notice he was not entirely convinced himself, for in the presentation of his charts, he spoke of middle lobes though he was trying to get away from this nomenclature and talk about commissural hypertrophies. Is it a wise change to favor commissural instead of middle lobe? I doubt it, for one would be forced to talk about a posterior commissural hypertrophy if one wished to refer to that which has been called middle-lobe hypertrophy as there are two commissures at the badder neck. This surely is not as simple as speaking of middle lobes.

The Albarran glandular hypertrophy as a clinical entity is a rarity here. I do not think that 2 per cent of the cases of prostatic involvement that come my way for operation are of the Albarran type. If we dismiss that type, I believe what Dr. Randall said is absolutely borne out by my experience. I believe that Zuckerkandl and Tandler hit the nail on the head in their studies in which they called attention to the fact that all the adenomatous masses develop anterior to the ejaculatory ducts though not always from the middle lobe. They are often lateral in their origin as well as in the floor of the posterior urethra above the verumontanum.

The posterior lobe becomes compressed against the capsule as the middle and lateral lobes develop their adenomas.

Whether it is so important in the surgery of lateral and middle lobe enlargement to know exactly what we are going to encounter before we start operating, I doubt. I believe we need an accurate picture if the approach is perineal, but for the suprapubic approach, I do not believe such an extensive preoperative study is essential even though we usually cystoscope all these cases.

The important thing to remember from this presentation is that in post-mortem studies the commissural, or middle lobe as we used to call them, adenomas start in much earlier than do those in the lateral lobe, and in the sixth decade, the two combined become the typical picture of prostatic obstruction.

Dr. O. S. Lowsley: This is a real contribution to a subject that interests us all. Dr. Randall has made a study of a very large series of cases and it is most interesting to me that he has reached the same conclusions that I have held since I studied this subject first from the embryological, and later from the pathological point of view. My series comprised 250 cases, which is very much smaller than this wonderful series reported on by Dr. Randall. I agree with him absolutely in everything that he says. It is very seldom that I agree with anyone in everything on one subject; but I believe that hypertrophy may begin in any one of the four sections of the prostate, for we all feel certain that it does not occur in the posterior lobe. Dr. Randall said it becomes a compressed

structure, although in middle life it is of equal importance to the individual.

Dr. Beer is entirely wrong about our New York lack of subcervical group enlargement. I found that 23.7 per cent of the males over thirty years of age had more or less enlargement of the subcervical group. When the growth is small, these patients pass from office to office, from city to city, and are discouraged by the statement that they are nervous or neurasthenic and to "forget about it." They will be found to have subcervical enlargement, but are very seriously affected because they suffer from frequency of urination, and if they have to pass urine every hour or half hour during the night they would naturally become neurasthenic. One must examine them very carefully and look for a subcervical enlargement. The true middle-lobe enlargement is quite rare, as Dr. Randall pointed out.

Regarding operation: until Hinman's modification came out, it was my custom to do 40 per cent of these operations suprapubically for the simple reason that when the subcervical group took part in the disease I found we were better able to remove the mass in its entirety from above; but since using Hinman's modification, we find that we get such good vision of the bed and of the vesical orifice that we are able to approach the orifice much better, and are able in most instances to get out very large subcervical masses. We have recently removed a subcervical mass as big as a small lemon.

It is very interesting to me to have Dr. Randall subscribe so thoroughly to the views which I have suggested, primarily from the embryological standpoint; and I think the reason Tandler has changed his viewpoint is to make it fit the embryology which has been completely elucidated since he and Zuckerkandl wrote their quite remarkable contribution to this subject. Of course, their observations were accurate to an extent, but our embryological studies of the prostate have made it possible to explain the pathological conditions much more satisfactorily.

Dr. H. H. Morton: I wish to thank Dr. Randall for the privilege of hearing the best description of the pathological anatomy of the prostate that I have ever listened to. We have all of us accepted the theory of prostatic hypertrophy as expounded by Tandler and Zuckerkandl because of the weight of their names in pathology and urology. The theory is an attractive one, i.e., the hypertrophy beginning in the subcervical portion of the prostatic glands and gradually encroaching on the healthy prostatic tissue, pushing it out of the way of the new-growing hypertrophic tissue until the old true prostatic tissue forms an enveloping capsule at the periphery with the newly formed hypertrophic mass enclosed within it.

We have held to this idea because we had no better one. Some three years ago I did some work on the pathological changes in hypertrophied prostates in Professor Bauer's laboratory in Vienna, and we could not make the facts, as we saw them through the microscope fit in with the Tandler and Zuckerkandl theory. We found the hypertrophy of tubules and muscular fibers extending all through the prostate in all of its lobes, and we failed to find the thinned-out remains of the original prostate at the periphery. At that time we had no real explanation of our findings, but tonight, in his beautiful demonstration, Dr. Randall has clearly shown what we had suspected but were not sure of, namely, that the hypertrophic change in the prostate may be universal and not confined to one particular group of glands, or it may affect only one limited part of the gland.

Dr. Randall's explanations have also been most helpful in directing the logical surgical approach for the removal of hypertrophied prostate, and he has shown how important is the study of the form and direction of the hypertrophy before deciding whether the prostate should be approached through the perineum or from above.

Dr. John Morrissey: Supplementing Dr. Randall's exhibition, I would like to exhibit a specimen from a case that I operated on four weeks ago. The patient was a man forty-two years of age who had suffered from retention for five years, and had had a Young's punch operation three years ago; he was relieved of his retention for a time, but it returned, and when I saw him three months ago the residual urine was again 16 ounces. I did a Young's punch operation on him at the time without much benefit and he bled for three months after the procedure. He then went into the hospital and by perineal prostatectomy I removed this specimen, a good-sized posterior lobe growth. While it does not correspond to the Albarran type, still when it was taken out it was in a lamella of its own, separated from the two lateral lobes. The bladder did not empty itself until this was removed. You can

see on the upper surface a small indentation where I took out a fair-sized piece when I did the Young's punch operation.

I have not had much luck with the Young's punch operation, and many others complain of the same lack of success; I think it is due to the fact that these cases are not properly selected. This may occur in cases which should be subjected to a prostatectomy, and not have a Young's punch operation; yet when that is carried out and the symptoms continue, the failure is charged against the punch operation. Within the past ten days I have used Dr. Dr. Braasch's instrument in two cases, one with 6 ounces of residual urine and the other with 11 ounces residual; and while they are only seven and nine days old the cases have done very well. That is the procedure where, after the removal of the obstructing portions, the prostatic area is fulgurated, as advised by Dr. Bumpus, and all bleeding is checked in that way. That disposes of the difficulty in the Young's punch operation. I think it requires nice judgment to decide whether the case is one in which to use the Collings' operation, or one in which the obstruction can be removed with the Braasch or Young's punch operation, which requires a radical procedure with complete removal of the obstruction, or as I have done in this case.

Dr. H. Jeck: Dr. Randall laid stress on the preoperative study of cases of prostatic hypertrophy which would determine largely the type of operation. I hope he will tell us more of the particular type of operation he employs for each type of obstruction. Dr. Lowsley mentioned the enlargement of the subcervical group in young men who are called neurasthenics. I wish he would tell us how he recognizes that type of subcervical group enlargement. What is the cystoscopic picture and just what does he do for them?

Dr. Clyde Collings: It was my privilege in 1920 to spend a month with Doctor Randall in Philadelphia. I want to recommend to all of you who have the time and opportunity to visit his clinic and see his wonderful collection of museum specimens; one sees there ten or fifteen examples of every type of prostatic obstruction that occurs.

Dr. F. T. Lau: There is no question of the absolute importance of a good cystoscopic study and thorough knowledge of prostatic or commissural enlargement before we decide what type of operation to use.

Dr. Randall (closing): Dr. Beer has caught me in my weak point and quite properly criticized my referring to middle lobes while speaking of my lantern slides. It is purely a bad habit from past usage, and my attempt this evening to differentiate them for you being in my own mind a question of recent birth, I inadvertently slipped while speaking of the slides.

I must agree with Dr. Lowsley that the subcervical hypertrophies are far from infrequent and as I showed you in my statistics they form 30 per cent of the hypertrophies when occurring alone, and if combined with the bilateral enlargements, their frequency immediately augments that figure.

I was most interested in Dr. Morton's reference to his experiences while in Vienna and it somewhat explains the change of attitude which Tandler and Zuckerkandl have taken in the recent edition of their book.

What I was particularly anxious to dwell upon was the choice of variation of the operation according to the type of hypertrophy present. I am convinced that there are definite preoperative pictures to be diagnosed from the clinical, cystoscopic and rectal examination which will place each prostatic patient in a definite group and will classify him as to the type of hypertrophy present. For instance, we have all seen the individual with hypertrophy and sudden complete retention, whom indwelling catheter drainage for a few days or more will tide over the acute retention, and on removing the catheter he will again start voluntary urination and will be found to have little or no residual urine. This is the type which has only bilateral extravesical lobe hypertrophy. This could be proved by both rectal and cystoscopic examination and at operation two separate lobes will be found and should be separately enucleated. A second type will be the individual who over a period of years has been enjoying fair health, but when examined will be found to be carrying a large residual urine which no amount of preliminary treatment will vary. Such a case will in all probability present on rectal and cystoscopic examination, in addition to lateral lobe enlargement, hypertrophy in the posterior commissure. At operation such an hypertrophy should be removed as one mass which will include both lateral lobes attached to one another by the hypertrophic commissural tissue. In either of the above types suprapubic or perineal pros-

tatectomy can be successfully performed, though here I personally like to make a differentiation, removing the commissural enlargements suprapubically and the simple bilateral ones perineally.

Where the subcervical glands hypertrophy, I feel it is always best to approach such a case through the suprapubic incision because of the anatomical origin of the enlargement and the fact that such lobes are always intrasphincteric, as well as an intravesical. These, I grant, are refinements of diagnosis and operative technique which, though they are not absolutely essential, have decided influences upon conservative surgery, minimizing injury, offsetting hemorrhage, and giving greater assurance of permanency of cure.

PRESENTATION *of* INSTRUMENTS

A MODIFICATION OF THE McCARTHY PANENDOSCOPE FOR CONTINUOUS IRRIGATION

CLYDE W. COLLINGS, M.D.

We have modified McCarthy's panendoscope by placing a small metal tube from the inflow faucet down to the end of the sheath. A small groove on the obturator permits it to pass easily by this metal tube.

The purpose of adding this feature to the McCarthy endoscope is to get rid of the annoyance of stopping a urethral or bladder operation to remove the water from the bladder, which, too, interefers with the progress of the operation, for the electrode has to be adjusted again.

With continuous irrigation the inflow and outflow can be nicely adjusted so that the bladder is not overdistended. Also the bubbles from the high frequency current are washed away. The irrigating medium washes away any bleeding that may occur. Lastly, a constant degree of distention of the prostatic urethra and bladder may be maintained.

PRESENTATION OF CASES

THREE CASES OF PROSTATIC INTRUSION OPERATED UPON BY THE ELECTROTOME CUTTING CURRENT

CLYDE W. COLLINGS, M.D

CASE 1. W. B., aged sixty-one years, admitted to Lexington Hospital December 3, 1926 with a complaint of inability to pass urine.

Previous and family histories essentially negative.

Present Illness: In June, 1926, the patient began to wet the bed at night; he was passing his urine every half hour by day and night, with marked urgency. He has experienced much difficulty and burning for the past three years. Mouth very dry since the onset of present illness. He has been very nervous of late and the family thought the patient's "mind was going off."

On December 3, 1926, he was referred to Dr. Archie Dean at the Memorial Hospital. Because of the great loss of weight he was thought to have a carcinoma. Cystoscopy by Dr. Dean revealed a median bar at the vesical outlet, deep bas fond, and a marked elevation of the floor of the bladder neck as the urethroscope was withdrawn into the posterior urethra. Creatinine 2.5 mg.; non-protein nitrogen 90. Phenolsulphonphthalein test: trace in the first two hours. Urine very cloudy and loaded with pus. By rectal examination the prostate was found slightly enlarged, regular, firm throughout, with no suggestion of carcinoma. An indwelling catheter was tied in the urethra.

December 7, 1926, electrotome excision of prostatic bar, under caudal anesthesia. Indwelling catheter for three days after the operation. The symptoms of renal insufficiency were more marked for the first few days after the operation. After the removal of the catheter the patient has continued able to void.

December 13, 1926. Discharged from the hospital. N. P. N. 40; creatinine 1.5.

December 16, 1926, urinates three or four times at night, every two hours during the day, burning is about gone. Urine cloudy but not bloody. Voids 8 ounces at a time. Residuum 4 ounces.

December 21, 1926: Residuum 3 ounces.

December 27, 1926: Residuum 2 ounces. Urinates twice during the night, every 2 or 3 hours during the day.

January 3, 1927: urinates twice in the night, every three or four hours in the day. Residuum, 1 ounce. Blood pressure 160/100. Urine contains less pus.

January 17, 1927: Residuum 1 ounce.

February 16, 1927 (nine weeks after operation): Residuum 1½ ounces; indigo-carmine 5 c.c. intravenously appeared in ten minutes in fair concentration. Has gained 21 pounds.

Case II. J. McG., aged seventy-eight years, admitted to Bellevue Hospital August 25, 1926.

Chief complaint: He passes all his urine through a suprapubic fistula since he was operated upon in Beth Moses Hospital, March 12, 1926—a suprapubic cystotomy for adenoma of the prostate. He was in such poor condition that he was sent home for several weeks.

On June 25, 1926, prostatectomy was performed at Cumberland Hospital. The suprapubic wound has never closed and he has never voided per urethram. The patient had gonorrhea forty-five years ago, chancre forty years ago.

On admission, rectal examination; prostatic bed flat, indurated, no nodules felt. Wassermann reaction, 2 plus. NPN 38; creatinine 1.8; blood pressure 140/75.

Operation, August 31, 1926. Spinal anesthesia. There is a band of scar tissue across the floor of the vesical outlet from five to seven o'clock with a moderate bas fond. The scar tissue was excised by making three incisions in the bladder neck, with the cutting high frequency current, at five, six and seven o'clock.

Following the operation the patient has been able to void continuously. The suprapubic fistula healed to a pinpoint opening but due to the dense scar tissue it refused to heal entirely.

October, 1926. The suprapubic fistula was excised. No obstruction to bladder neck was found. There was a deep groove posteriorly, apparently made by the cutting high frequency current. The bladder was closed tight. Indwelling catheter tied in the urethra for three days.

Wound healed per primam. Discharged October 29, 1926. General condition good. Residuum 15 c.c. Urinates every two or three hours in the day, two or three times at night.

February 16, 1927 (five and one-half months after operation). Residuum, none. Up once at night, rarely twice; urinates every three or four hours by day. Working every day. Has regained his normal weight and strength.

Case III. J K., aged sixty-seven years, admitted to Bellevue Hospital November 10, 1926.

Past History: One year ago the patient developed painful urination, relieved for six months by prescription.

Present Illness: Six months before admission he developed complete retention and his Doctor prescribed a catheter which he uses two or three times a day and once at night. He came to the hospital because he gets spasms with terrific pain in the rectum referred down both legs.

Rectal examination: The prostate was somewhat enlarged, especially the left side, stony hard, fixed. It felt even harder on the right side. Diagnosis: carcinoma of the prostate. Urine negative except for a trace of albumin and clumped pus cells. NPN 39; creatinine 1.5.

November 23, 1926. Spinal anesthesia. Very difficult to introduce the McCarthy panendoscope. It required great depression of the ocular and a finger in the rectum to get the instrument by the carcinomatous bar across the vesical outlet.

Cystoscopy: No lateral lobe intrusion, a marked bar at six o'clock. A deep valley was cut in the bladder neck from five to seven o'clock to a depth of 2 cm. and extended as far back as the verumontanum. No bleeding. Indwelling catheter for three days. Following the removal of the catheter patient has not required catheterization

November 30, 1926. Radium implantation under spinal anesthesia. Through an inverted U incision of the perineum, with a sound in the urethra as a guide, the prostate was exposed in the usual manner to the apex. The Young tractor was placed through the urethra into the bladder which gave good exposure. The lower part of the seminal vesicles was also exposed. Fifteen gold capsules containing about 1.5 mc. emanation each were placed in the prostate and lower seminal vesicles.

January 13, 1927. Rectal examination: the left lateral border of the prostate was very hard, the right felt normal. Residuum 4 ounces. Has gained 10 lbs. Up two or three times at night; during the day urinates every one and one-half to two hours.

February 16, 1926. Residuum less than 2 ounces.

Discussion

Dr. A. R. Stevens: Dr. Colling's cases call for only favorable comment. He is able to get out more obstructing tissue than one usually gets with the ordinary Young's punch operation. In cases of carcinoma where one implants seeds of radium emanation, it is well recognized that although the carcinoma may

decrease in size afterward, one fails to get rid of the residual urine and consequently cannot cut down the degree of urinary frequency. It would seem that one must either do a Young's punch operation or open the patient suprapubically and by cutting or cautery remove a large part of the obstructing tissue at the vesical outlet. It seems to me that this method of Dr. Collings does that as well, if not even better, than one can accomplish it through a suprapubic opening, and the individual gets out of the hospital much more quickly.

DR. O. S. LOWSLEY: I wish to express approval of that part of Dr. Collings' report in which he does not approve of this method in adenopathy of the prostate. Of late years there has been a considerable amount of meddlesome surgery in these cases which later come to prostatectomy; they give the patient a false sense of security and cause the postponement of the removal of the prostate until he is in a worse condition to stand operation as regards his blood vessels, recurrence of residual urine, etc. In the Academy of Medicine some years ago, some one reported a palliative procedure of this sort, and called the patient cured, with residual urine of 8 ounces!

DR. A. L. DEAN: The first patient shown by Dr. Collings was referred to me with the diagnosis of carcinoma of the prostate. In addition to the details of his physical examination as recited by Dr. Collings, all of which indicate his precarious condition, there were 960 c.c. of residual urine. When my examination revealed no tumor, but an obstructing bar formation, I considered the patient ideal for the therapy at which Dr. Collings is so adept. When the patient was returned for my examination a few days after his operation the general improvement was striking. My impression is that this method is an excellent one when employed for the proper indications.

DR. A. HYMAN: I would like to supplement Dr. Lowsley's remarks concerning the use of this instrument in prostatic adenoma. I consider it a dangerous procedure to attempt intraurethral excision of portions of the prostate when there is a large amount of infected residual urine. During the past year I know of two instances in which this was followed by serious consequences. One patient died from hemorrhage and sepsis and the other patient ran a very stormy course until relief was obtained by a suprapubic cystotomy. The type of instrument presented by Dr. Collings is of undoubted value in the treatment of median bars or contracture of the neck of the bladder.

BILATERAL HYDRONEPHROSIS AND HYDROURETER SECONDARY TO SPINA BIFIDA WITH CONGENITAL SPINAL CORD DEFECTS

CLARENCE G. BANDLER, M.D., F.A.C.S.

E. S., male, aged twenty-four years, was admitted to the N. Y. Post-Graduate Hospital October 25, 1926, on the service of Dr. Herman Mosenthal. The case is presented through his courtesy.

On admission the patient was in an ambulatory condition and his temperature, pulse and respiration were normal. The chief complaints were: 1. An ulcer on the sole of the left foot which had been present for one year. 2. Shrinking of the left leg and foot for six months. Both family and personal history were negative.

Past History: The patient was born with spina bifida. He had had no serious illnesses which had confined him to bed with the following exceptions: 1. Measles and scarlet fever in childhood. 2. Tonsillectomy seventeen years ago. 3. Operation on bladder twelve years ago at Bellevue Hospital; diagnosis unknown. 4. Influenza seven years ago. 5. He had always had urinary difficulties, consisting of lack of control; necessity for urination after every appreciable intake of fluid; difficulty in starting the stream and terminal dribbling. He has regularly voided once during the night. Venereal diseases were denied.

Physical Examination: Enlarged heart. Aortic dilatation. Moderate hypertension, evidenced by a blood pressure 172/90. Atrophy of the left leg and foot with 8 cm. shortening. A neurotrophic ulcer on the sole of the left foot. Spina bifida with failure of closure of the sacral arch. All abdominal reflexes present except the upper lateral on the right side. Slight secondary anemia, the erythrocytes being 3,900,000 with a color index of 1. Spinal fluid negative for cells, globulin, Wassermann and colloidal gold tests.

The subsequent course of events was rather interesting. For the next few days the patient was apparently comfortable, being up and about. Two days after admission, cystoscopy was performed as follows: A large instrument was introduced into the bladder without encountering any obstruction and with an

entire absence of pain. One hundred and twenty cubic centimeters of cloudy, residual urine were evacuated from the bladder. The mucosa showed marked generalized trabeculations and sacculations, two of which suggest the openings of diverticula. The ureteral orifices were normal in size, shape and position and both were visibly functioning. There were no evidences of new-growth or calculi. The internal sphincter was normal in contour, with no unusual angulations nor intrusions. On the anterior aspect of the internal sphincter, and along the floor and lateral sulci of the posterior urethra, down to the veru montanum, were numerous trabeculae, with one deep sacculation, also suggestive of a diverticulum. The veru montanum was atrophic and neither the ejaculatory nor prostatic ducts were visible. My impression was that this entire condition was due to faulty nerve supply as a result of an old spinal cord lesion.

Neurological examination revealed an old spina bifida involving the second, third and fourth sacral arches, with the nerve roots caught in the sac, and adherent to it.

Five days after admission the patient had a chill with temperature rising to 103.6°. He was given glucose retention enemas containing sodium bicarbonate and five days later his temperature returned to normal, although he complained of severe headache, and he occasionally vomited. On November 9, an indwelling catheter was introduced to relieve complete urinary retention and at this time the urea nitrogen rose to 141.4 mg. per 100 c.c. of blood, while the creatinine was 15.1. The patient then was vomiting almost continuously, not only his food, but also a large amount of bile-tinged fluid; and the carbon dioxide volume was 31.5 per cent. This acidosis, with the concomittant uremia, was combatted with large amounts of sodium bicarbonate and glucose solution introduced through the duodenal tube as well as by hypodermoclysis and proctoclysis. The condition gradually became worse with continuous vomiting and the patient was irrational. Intravenous infusions of glucose were administered daily, as well as retention enemas. The urea nitrogen, measured daily, ranged about 150, while the urine showed but a faint trace of albumin with many white and red blood cells. The temperature showed a septic curve, being as high as 105.6°F. Measures were taken to combat shock and at this period the patient seemed about to die. To the aforesaid therapy oxygen inhalations were added and finally the patient showed some response, so that on November 22, his temperature had dropped to normal, although the urea nitrogen was 148.9 and creatinine 9.

Three days later (November 25) the patient entered a similar episode lasting until December 6. The therapeutic measures heretofore utilized were repeated, resulting in a slow return to a rational condition. On December 21, cystoscopy was again performed for the purpose of estimating the separate renal function. No indigo carmine was excreted from either kidney at any time. A week later, separated phenolsulphonphthalein tests were made and there was no secretion during an entire day, from either kidney, while blood chemistry showed urea nitrogen 54.0 and creatinine 8.5.

On January 6, 1927, am ureteropyelogram was made on the left side, using 40 c.c. of 12 per cent sodium iodide solution. Five days later this procedure was repeated on the right side and enormously dilated ureters and kidneys were found. The urine obtained from each kidney at these cystoscopies revealed a large amount of protein with a few red and white blood cells from the left side, with no protein and an occasional white blood cell from the right. Cultures showed no growth after forty-eight hours.

The patient was now comfortable, had no pain and had stopped vomiting. The blood pressure which had been 120 to 130 systolic during the phase of acute acidosis was now 160 systolic. On January 15, the patient left the hospital apparently feeling well and has since continued under my care with no evidence of further disturbance except the development of a trophic ulcer on the posterior aspect of the left thigh, which now is almost entirely healed. I feel that the pathologic condition evidenced in the genito-urinary tract is unquestionably due to the lack of proper bladder function as a result of the alteration in the spinal cord and the lower peripheral nerves.

The table shows the entire blood picture in this patient, the deductions from which will be further elaborated by Dr. John A. Killian.

Discussion

Dr. J. A. Killian: This type of case is both interesting and instructive from the chemical standpoint. There are two things of practical

CHEMICAL CHANGES IN THE BLOOD OF E. S.

Date	Urea Nitrogen	Uric Acid	Creatinine	Sugar, mg. per 100 c.c.	Chlorides, mg. per 100 c.c.	Calcium, mg. per 100 c.c.	Phosphorus, mg. per 100 c.c.	Cholesterol, mg. per 100 c.c.	CO_2 Combining power vol. per cent
Oct. 26, 1926	70.0	...	10.7	102	...	....	....	...	37.2
Oct. 28, 1926	.....	...	....	106	...	9.8	12.5	...	39.0
Oct. 30, 1926	73.3	...	....	140	...	....	....	...	36.6
Nov. 3, 1926	.....	...	....	116	...	....	....	...	33.4
Nov. 5, 1926	66.0	...	....	122	...	....	....	...	39.0
Nov. 9, 1926	141.4	...	15.1	90	...	....	....	...	31.5
Nov. 12, 1926	70.6	4.4	13.1	94	340	9.2	21.8	...	31.5
Nov. 16, 1926	154.8	...	....	...	...	....	....	...	49.4
Nov. 18, 1926	150.0	...	9.6	156	...	11.0	7.1		
Nov. 19, 1926	.....	...	....	...	...	....	....	...	48.5
Nov. 24, 1926	148.0	...	9.0	87	486	....	....	...	60.7
Nov. 26, 1926	112.6	...	11.5	...	...	....	....	...	62.6
Nov. 29, 1926	109.3	...	11.3	...	...	....	....	...	39.0
Dec. 3, 1926	74.0	...	....	...	...	8.0	11.7		
Dec. 10, 1926	60.5	...	5.6	...	...	....	....	...	54.1
Dec. 17, 1926	51.3	...	4.5	86	526	....	....	206	48.5
Dec. 28, 1926	54.0	...	8.5	...	526	....	....	...	39.0
Jan. 4, 1927	52.5	9.4	....	...	...	....	....	...	40.9
Jan. 11, 1927	47.5	4.7	....	92	544	....	....	...	40.9
Jan. 20, 1927	115.2	8.9	8.1	...	501	10.6	6.4	184	35.3
Feb. 3, 1927	72.5	7.4	8.6	77	503				

Jan. 20, 1927 Hemoglobin = 12.5 per cent
Total serum protein = 6.92 per cent
Globulin = 1.78 per cent
Fibrin = 0.780 per cent
Albumin = 5.14 per cent

importance that I would like to point out on the slide. First of all, if we consider the concentration urea and creatinine, the fact is impressed upon us that the urea and creatinine are increased to about the same concentration in all specimens. If the urea is ten times the normal, the creatinine is about the same. These findings are typical of cases in which the accumulation of nitrogenous waste products is due to mechanical obstruction, as Foster has shown experimentally in dogs.

The fact that creatinine rose to 15 mg. is not necessarily indicative of a poor prognosis. In a similar case, we have seen creatinine rise as high as 23 mg. per 100 c.c., with a good recovery. However, this man's creatinine does not return to the normal degree, the lowest figure being 4.5 mg. His kidney function never approaches the normal.

Another fact of practical importance is the value of the CO_2 combining power of the blood, following a tendency to acidosis and following impairment of the renal function. Note that the CO_2 combining power is never very low, and that is due to the fact that he was always receiving alkaline therapy. However, the inorganic phosphorus of the blood continued to rise. The acidosis in the nephritis is due to failure to remove the acid phosphates from the body. Although we can bring up the CO_2 combining power, we cannot decrease the inorganic phosphorus by this means. If we follow the nephritic tendency to acidosis we must include in the blood analysis determinations of the inorganic phosphorus and calcium. This inorganic phosphorus rose to 21 mg., which shows a tendency to an acidosis in spite of the increase in the CO_2 combining power. The thing to be concerned about in the acidosis of nephritis is the decrease in the calcium; that is always indicative of a poor prognosis; and in this individual the therapy was so regulated that although we brought up the CO_2 combining power of the blood to a fairly normal figure, this increase did not result in a drop in the calcium.

POLYCYSTIC KIDNEYS (BILATERAL) WITH BILATERAL HYDRONEPHROSIS

CLARENCE G. BANDLER, M.D., F.A.C.S.

This case reveals a urinary condition similar to the preceding, due, however, to an entirely different disease process. The patient, Mrs. M. C., aged thirty-four years, was seen by me on December 1, 1926, in consultation with Dr. Carlucci. She was in bed, acutely sick, with temperature 103.6°F., and unable to urinate. Two large, easily palpable abdominal masses comparable to the kidneys were noted. I had her transferred by ambulance to the Post-Graduate Hospital, where her history was as follows:

Chief Complaint: (1) Severe pains in back since birth of last child, thirty-six days before. (2) Inability to void urine. (3) Voiding of thick and bloody urine during the past month, which was probably due to contamination by the discharged lochia. (4) Passage of bloody, fleshy masses from the vagina for the previous thirty-six days.

Previous History: No illnesses, accidents nor operations since childhood. She has had no miscarriages and has five children alive and well. All confinements were with the assistance of a midwife only, despite the fact that the patient is the sister of a physician.

Present Illness: Immediately following the birth of the last child, she began to feel bad and had been in bed ever since, suffering from fever, general malaise, bloody discharge from vagina and questionable hematuria.

Physical Examination: Head, neck, heart and lungs essentially negative. Abdomen showed generalized tenderness with muscular rigidity and apparently there were large masses with nodulated surfaces in each flank extending forward to the median line on the right side and almost to the same point on the left. Tenderness over both kidneys. Vaginal examination revealed a profuse bloody discharge with an irregularly lacerated cervix which was freely movable. No masses nor induration palpable in the cellular tissue. The uterine corpus was enlarged, but not especially tender. A diagnosis of subinvolution was made. Rectal examination: Severe anal spasms with mucopurulent discharge and dilatation of hemorrhoidal veins.

Course of the Disease: The patient's temperature fluctuated between 101°F. and 104.8°F. with intermittent vomiting, and she was immediately given daily high colonic irrigations, catheterization and vesical lavage. Fluids were forced to 3000 c.c. daily, by mouth, intravenously and by hypodermoclysis.

On the day after admission, cystoscopy was performed, which revealed no cystitis, ureteral orifices normal in size, shape and position, and both were visibly functioning. No. 8 F. catheters were introduced 30 cm. up each ureter without encountering any obstruction. Numerous specimens of absolutely clear urine were obtained from each kidney at a very rapid and continuous rate of flow. During this examination 10 ounces of urine were collected from the right side and 9 ounces from the left. The patient was returned to bed with catheters indwelling in each ureter for the purpose of further drainage and a phenolsulphonphthalein test was performed. In two hours 230 c.c. of urine were obtained from the left side with but a trace of phenolsulphonphthalein and 250 c.c. from the right with no evidence of phenolsulphonphthalein. The urine from the left side showed numerous red blood cells and 10 to 15 white blood cells, per high power field. No microorganisms were found and the culture showed no growth in forty-eight hours. The urine from the right kidney showed 20 to 30 red blood cells and 30 to 40 white blood cells per high power field. No microorganisms were found and culture showed no growth in forty-eight hours.

Under forced fluids and colonic irrigations, the patient markedly improved and two weeks later (December 16), an ureteropyelogram was made on the right side using 55 c.c. of 12 per cent sodium iodide solution, but much more could have been introduced. There was no discomfort during this procedure. Forty-eight hours later an ureteropyelogram was made on the left side using 60 c.c. of 12 per cent sodium iodide solution and again more could have been introduced as there was no discomfort. At each of these cystoscopies the findings were identical with the examination of two weeks previously, and as before, there was a continuous flow of clear urine from each side. The *x*-ray diagnosis was bilateral hydronephrosis with hydroureters.

The blood count showed no leucocytosis or anemia.

Following the cystoscopy the tumor mass on the right side of the abdomen decreased about

one-third in size, while the mass on the left side also decreased, but not to the same extent. Palpation at all times revealed an irregularly nodulated surface over the anterior aspect of both kidneys.

BLOOD CHEMISTRY

Date	Urea N mg. per 100 c.c.	Creatinine	CO_2 per cent	Sugar
December 2, 1926...	61	11.1	40.9	0.123
December 9, 1926...	51.1	4.7	54.1	
December 23, 1926..	21.2	3.0	53.2	

Diagnosis: polycystic kidneys (bilateral) with bilateral hydronephrosis and hydroureters.

The patient left the hospital on December 24, 1926, in poor condition, but several weeks later at home, her general condition was fair and she was able to perform a moderate amount of housework.

(No discussion)

PROBABLY CONGENITAL BILATERAL URETERAL AND RENAL DILATATION

STANLEY R. WOODRUFF, M.D.

E. S., aged sixty-four years, male, white, a butcher, complained of frequency and nocturia since about twelve years of age. At twenty-five he was treated by a well-known urologist for what he termed tuberculous orchitis. At this time there was swelling and abscess formation of both sides of the scrotum which were incised and drained. Fistulae resulted from these, and discharged for several years before final healing took place. About this time there was considerable frequency and dysuria, with some hematuria. He remained fairly well up to about two years ago, when he noticed decided diminution in the stream, added frequency and nocturia, and greater cloudiness in the urine. His chief complaint was chronic retention. Four weeks previously the patient was entirely unable to urinate, and catherization became necessary. He claimed that after two weeks of this he began to pass urine by rectum.

He was a fairly well-nourished man past middle life, well able to walk, and in full possession of all senses. There was moderate distention of the lower abdomen, evidently caused by an overdistended bladder. All reflexes were normal, and the blood and spinal fluids were Wassermann-negative. Heart and lungs, negative. The blood chemistry showed urea nitrogen 20, creatinine 1.55.

The urine by catheter was of intensely foul odor, with a specific gravity of 1021, and contained albumin and a large amount of pus; no sugar. Roentgen examination was negative for stone. Rectal touch disclosed a mass well back in the rectum that was irregular and somewhat indurated without other delineation. There was no prostatic intrusion. Cystoscopy discovered an immense amount of residual urine. The bladder was grossly trabeculated, had a large capacity, and at the normal position of the ureteral openings were large, regular apertures that simulated diverticula. The posterior urethra contained one large, irregular linear opening that admitted a 5 cm. catheter, but no definite connection with the rectum could be established. There was no prostatic intrusion into either the posterior urethra or the bladder. Catheters passed into both openings that were previously described as being in the normal position of the ureters, and easily advanced 24 cm. on both sides. The cystoscope was withdrawn, a catheter inserted into the bladder, 250 c.c. of 10 per cent sodium iodide solution injected, and exposures made. Roentgenograms showed immense dilatation and loss of secreting tissue equally of both kidneys, dilatation and tortuosity of both ureters, with the bladder not entirely filled.

Under urinary antiseptic treatment and extensive lavage of the entire urinary tract, this patient improved very much, and left the hospital in fairly good condition. He became able to void again fairly well for ten months, when another sudden attack of acute retention brought him back to the hospital, at which time the blood chemistry showed urea nitrogen 55.5, creatinine, 1. A retention catheter was then inserted, and after two weeks' drainage, urea nitrogen was 93.75, the creatinine, 3.5. At about this point the patient developed a severe general toxic erythemia, and died in two days.

The interesting points of this case are the length of time that this man had evidently lived with little or no kidney secreting tissue, the simulation of prostatic disease, and the question as to whether his condition was of congenital origin, or a dilatation due to long-standing inflammation and absorption of the various coats of the bladder, ureter and renal pelvis.

(No discussion)

TRANSACTIONS OF THE SECTION OF
ORTHOPEDIC SURGERY
NEW YORK ACADEMY OF MEDICINE

Meeting of February 18, 1927

THE CHAIRMAN DR. HARRY FINKELSTEIN, PRESIDING

[There were no discussions at this meeting]

RECONSTRUCTION PROBLEMS *of the* PARALYZED UPPER EXTREMITY

PRINCIPLES OF EDUCATION; IMMEDIATE AND END-RESULTS OF OPERATION*

A. STEINDLER, M.D., F.A.C.S.

IOWA CITY, IOWA

LOOKING back upon the reconstruction work of the upper extremity, which was begun ten years ago with a good deal of hesitancy and apprehension, I find much that has stood the test of time and has given me hope and encouragement; but also, on the other hand, much that invites criticism and gives cause for further investigation. Quite naturally it is the latter kind of experiences that is of the greatest interest.

From the beginning of the work, in order to find orientation in a rather poorly explored field, we tried to analyze the whole complex mechanism of the upper extremity into its simpler components, setting these up, as it were, as concrete and definite aims for reconstruction. So we came to evaluate the disabilities, point for point: failure of abduction of the shoulder; or of flexion of the elbow; or of pronatory and supinatory power of extension of the wrist; of the ability to close the fingers; and finally that of opposing the thumb. These were the elementary reconstructive aims and, to meet these, treatment in general and operative procedures in particular were fashioned. I believe that this plan of procedure in its almost naïve simplicity has served us well as a starting point and, on the whole, it still stands as the guiding principle in planning the work of reconstruction. Subsequent experiences, however, taught us that the rules required qualifications. These qualifications rose from several sources. Two of them are of particular interest:

The first is of muscle dynamic nature. It concerns the counter-effect of muscle contraction upon the central point of application. In our mechanical calculations we too often take it for granted that the effect of muscle contraction at the peripheral point of application is entirely dynamic, and at the central point entirely static or stabilizing. We found, however, in several instances that the effect of the central action occasionally became quite evident, leading to dynamic changes and to disalignment. This instigated a much

* Also read before the Boston Orthopedic Club, February 14, 1927.

closer study of muscle dynamics from the point of central and remote reactions upon the skeleton, a point of view which, of course, should be the only permissible one in the study of the kinetics of the upper extremity but which had not been fully appreciated until untoward effects of muscular counteraction were observed.

For instance, in abduction of the shoulder: In the general plan the main principle of bringing about abduction by movement of shoulder blade and humerus as a whole is satisfied by the operative plan, but it did not cover the case of counteraction of the shoulder girdle musculature upon the spine; consequently cases of disalignment were observed that might have been anticipated.

Another point of embarrassment often arose out of the field of the so-called substitutionary or secondary movements. For instance, the ability to produce pronation and supination by rotation in the shoulder joint; of extension of the elbow by forward flexion in the scapulohumeral articulation, etc.

We now realize how important it is to study the possibilities of substitutionary movement. In the first place, without knowledge of the natural routes of substitution an operative plan can hardly be formulated without frequently turning out to be a piece of meddlesome surgery. Furthermore, muscle training and muscle drill must be based on facts of substitutionary movement to a large extent. The teacher must be conversant with the usual tricks the patient uses to cover up his deficiency.

A third difficulty arose from the failure to recognize and appreciate secondary muscle action. For instance, in the substitution of the missing flexion action of the elbow we are handicapped by secondary pronatory action of the transplanted flexor muscles. Special provision also must be made to avoid this undesirable complication.

I hardly need to say that the dynamics of muscle action are not as simple as the textbooks of anatomy would lead us to believe. Never better than in the upper extremity do we realize that muscle function is not a constant, and that the action of one muscle or, rather, the actions of one muscle, must be described in terms of function dependent upon the particular position of the joint at the time of action. To describe a muscle by the direction of its pull in one or even more planes of the body gives a very incomplete picture of its function unless the relative ratio between the different movements in the different planes is also given, as well as the position of the joint in which this motion or these motions may occur in their respective relations of strength and excursion.

For these reasons, I am doubly thankful for the opportunity to present this subject again and I hope to be able now to add to the discussion of former years some influx of critical analysis along such lines as I have just indicated. Many failures we have been able to explain upon the disregard or oversight of physiological or dynamic principles. As we advance in the work, we hope to receive further light on the cause and nature of our shortcomings, from the fundamental sciences upon which this work must stand.

PROBLEM I. THE FLAIL SHOULDER

The principal indication is the paralysis of the deltoid muscle. It is stated that abduction of the arm into a field in which the extremity may sweep over the spherical quadrant that lies in front of and lateral to the shoulder joint is an essential for the practical use of the extremity. If the deltoid muscle is permanently paralyzed (and the burden of proof here rests with the observation and the treatment of the first year or two after the paralysis), then the indication is arthrodesis of the shoulder joint, since we know, at this time, of no other satisfactory method of transference of muscle power from the shoulder girdle to the humerus. Even though ample muscle material might

be at hand, the anatomical conditions are unfavorable for the muscle transplantation; the essential mechanical conditions cannot be met. In the arthrodesed shoulder it is the trapezius and serratus muscles in combination, that, by rotatory action upon the shoulder blade in the sternoclavicular junction, bring about the elevation of the arm. As we study the muscle dynamics of the shoulder girdle we find that the muscles are paired in their action in a peculiar way. The upper portion of the trapezius and the pectoralis minor both acting in the same directions, swing the shoulder blade obliquely from above and behind to forward and downward, the oblique back and forward swing. Then the middle trapezius, with the serratus magnus, brings the shoulder blade back and forward, also acting in the sternoclavicular joint, the horizontal back and forward sweep. Then the rhomboids and the lower serratus muscle swing the shoulder blade from above and backward to downward and forward, also an oblique sweep, but this time more in the acromioclavicular junction. Finally, a fourth pais is represented by the levator scapulae and the lower trapezius pulling the shoulder blade upward and downward along the vertebral border, the action taking place mostly in the sternoclavicular junction, a perpendicular sweep. All these motions are independent of the rotatory motion of the scapula which again can be modified in its direction by any of the aforementioned pairs of muscles, as they favor sweeping motion in a particular direction. It must be calculated which of these would be the most useful for the arm in the given case.

If paralysis of the deltoid exists, this does not necessarily settle the indication. The question arises: Is a substitutionary motion for the loss of the deltoid muscle possible? In the stricter sense of the word it is. By simultaneous contraction of the biceps and triceps muscles such stabilization of the humerus against the glenoid fossa can be obtained that humerus and scapula almost move as a unit, so that the contracting trapezius accomplishes abduction of the arm. For the unilateral cases this is hardly a satisfactory solution. But for bilateral cases, in which there are certain objections to the fusion of both shoulder joints, one will do well to consider the possibility of substitutionary motions on these grounds.

In my series are 65 operations for arthrodesis of the shoulder. Of these a large majority, probably about 80 per cent, have shown what can be considered good end-results, the time of observation extending over ten years. This statement does not, however, exactly cover the situation. We find cases in which the elevation of the arm by means of the trapezius muscle is 90° and over, and we find others in which it barely reaches 45° or 50°. In general, those cases in which osseous fusion was obtained gave better results but, on the other hand, fibrous union does not always vitiate the operative result. Above all, we find that the type of fusion was not always in accordance with the ultimate dynamic effect obtained. As we examine the cases more closely we come to recognize that each case has a certain optimum of position in which fusion will yield the best possible advantage. This does not mean that one must vary position with each individual case but, according to the conditions of the muscles of the shoulder girdle, the cases may be grouped and the desirable position for the fusion may then be determined.

In the shoulder paralysis following anterior poliomyelitis we have the following situations:

1. The deltoid is paralyzed but all other muscles are preserved.
2. The deltoid is paralyzed and, in addition, the serratus magnus.
3. The deltoid is paralyzed and, in addition, the rhomboids and levator scapulae.

Each of these problems demands slighly different arrangement according to their mechanical constellations.

1. *The Deltoid Alone Is Paralyzed.* The

question is to establish the optimum position in which the shoulder joint is to be fused. Let us consider the purely frontal abduction of the arm. We find that in this position a strong demand is made upon the contraction of the middle fibers of the trapezius, coming from the spine of the scapula, and also of the rhomboids. Cooperative with the trapezius action is that of the lower serratus fibers which support the upper portion of the trapezius in the rotation of the shoulder blade. The middle fibers and the rhomboids are engaged in stabilizing the upper, inner angle of the scapula. When, by action of the serratus muscles, the lower angle of the scapula clears the side of the thorax further action of the serratus is hereby mechanically impeded; while the upper portion of the vertebral border remains close to the spine the lower angle of the vertebral border leaves the thorax. We see, therefore, that in abduction of the arm in the frontal plane the serratus loses in effect and influence the more the lower angle of the scapula protrudes. To this we must add the fact that this angle slips out from the upper edge of the latissimus dorsi which further embarrasses the power of the serratus.

A further limitation arises from the tension of the coracoclavicular ligament. Thus, if we wish to abduct the arm farther, it becomes necessary to incline the trunk to the other side.

In contrast to this let us examine the situation when the arm is elevated in anterofrontal or diagonal plane. Here elevation of the arm is accomplished to a much higher degree than in a purely frontal plane. The scapula is brought more in sagittal direction by the action of the pectoralis minor. The coracoclavicular ligament becomes taut much later, and the impingement of the coracoid process on the lower edge of the clavicle is evaded by torsion in the sternoclavicular joint. The lower angle of the scapula stays close to the thoracic wall. The rhomboids are relaxed and offer no obstacle to the torsion of the shoulder blade. The upper trapezius and levator anguli scapulae and also the lower portion of the serratus can now contract to best advantage, giving the scapula the highest possible degree of rotation.

It follows, therefore, that from the muscle-mechanics point of view, in fusion of the shoulder joint for deltoid paralysis when both trapezius and serratus magnus are acting, the optimum position is that of abduction and forward flexion which will give the arm a sweep in an antero-diagonal plane.

2. *The Serratus Magnus Is Paralyzed in Addition to the Deltoid.* Owing to the lack of serratus action the scapula is pulled upward and backward by the uppermost fibers of the trapezius muscle; this becomes more marked as the arm is weighted down, and, when the arm is carried forward the scapula becomes winged. The strongest contraction of the trapezius is not able to bring the lower angle of the scapula beyond the posterior axillary line. On the other hand, we find that the serratus paralysis is least noticeable when the arm is brought in abduction in the purely frontal plane, since in this position the serratus muscle is called upon to act only partially. In this position, also, the marginal portion of the trapezius muscle effects a rotation of the scapula of sufficient degree, although it does not attain the range of normal conditions. This leads us to the conclusion that in the presence of a serratus paralysis arthrodesis of the shoulder for loss of deltoid should be carried out more in the frontal plane (Fig. 1.)

3. *Rhomboids and Levator Are Paralyzed in Addition to the Deltoid.* The upper portion of the trapezius substitutes for the lost tension of the rhomboid and levator muscles. If the shoulder is lowered and the lower angle of the scapula moves outward, the loss of the opposing rhomboid action deprives the serratus magnus of a fixed point of application, thereby secondarily and potentially weakening its power. Fusion under this condition is best carried out in a position midway between the

anterolateral plane, which applies to the first situation, and the purely frontal plane which applies to the second situation, that is, in a position of slightly forward diagonal plane. (Fig. 1.)

At what angle should fusion be obtained? In general, in children at 90 degrees, in adults at 60 degrees to 70 degrees, but this would apply to situation 1 only.

In paralysis of the rhomboid, rotation of the scapula is considerably impaired and in these situations the fusing angle should be 90 degrees or slightly above.

We have not considered the situation which not infrequently arises in *paralysis of the pectorales muscles*. In this situation a strong point should be made of bringing the arm in sufficient degree of forward flexion, since the pectorales, the principal force in this direction, are lacking, and only the serratus and anterior fibers of the trapezius are left to bring the shoulder blade forward.

PROBLEM II. THE FLAIL ELBOW

Biceps and tibialis anticus as well as brachioradialis muscle are paralysed. The operation most adapted to this situation is the muscle transposition of flexor plasty of the elbow. Thirty cases were operated on.

The analysis of elbow flexion teaches that biceps and brachialis anticus are the two principal flexors. The biceps works better with the elbow extended and the humerus extended dorsally because then both of its heads are under tension. The situation is less favorable when the humerus is carried forward.

The brachialis anticus is independent of forward and backward movement of the humerus.

The brachioradialis is third in line of the flexors of the elbow; it is also a stabilizer of the forearm in regard to pronation and supination, insofar as it maintains the forearm in a mid-position. When these three muscles are paralyzed there is no efficient flexor of the elbow left except the extensor carpi radialis longior; but its flexion effect is small and does not start until after the first 20 degrees of flexion. The other muscles having their origin in front of the elbow axis are the flexors arising from the internal condyle. Their line of pull is so close to the transverse axis of the elbow that their flexing component becomes exceedingly small.

The principal point of the operation used for this condition is to release the common heads of the flexors of the forearm from their attachment to the

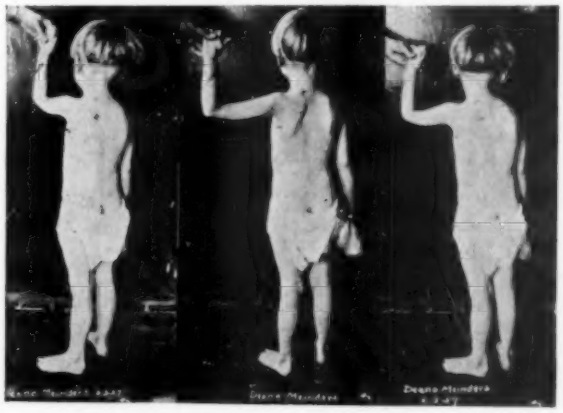


Fig. 1. Position of the arm for arthrodesis of the shoulder. A. Paralysis of the deltoid and serratus. B. Paralysis of deltoid. C. Paralysis of deltoid and rhomboids.

internal condyle and to transpose them higher up on the humerus so that they may develop a greater momentum for elbow flexion as the distance of their point of insertion from the transverse axis of the elbow is increased.

But, in this same group of muscles, the pronator radii teres, the flexor carpi radialis, palmaris longus, and flexor carpi ulnaris, all, with the exception of the latter muscle, are pronators as well as flexors of the elbow; and, by central displacement to the higher point at the humerus, they increase not only their flexion power at the elbow, but their pronatory component as well. If the extensors of the wrist and fingers are strong they may sufficiently neutralize this increased pronatory tendency by their own supinatory element. If not, however, one will find the strongly increased pronation an objectionable feature which may

considerably jeopardize the end-result. One must then either lengthen the tendon of insertion of these muscles in order to weaken their pronatory capacity, or else the peripheral tendons of the muscles may be transposed from their point of insertion backward across the forearm to act as supinators. To this end the pronator radii teres may be severed at its point of insertion and united with the muscle belly of the flexor carpi ulnaris; both are led around the ulna to the dorsal side of the forearm and fastened to the outer side of the radius close to its distal end, and are thereby transformed into supinators while they retain their proximal effect as flexors of the elbow. This simply goes to show that in rearranging muscles both insertion and origin must be analyzed and entered into the calculation of their mechanical efficiency. Such a situation may often arise in spastic paralysis where we frequently see pronation contracture. Holding the forearm in mid-position between pronation and supination is of considerable dynamic import.

Supinatory and pronatory movement can be substituted by rotations in the shoulder joint. If the shoulder joint is fused, as is the case in many instances in which a combined operation of fusion of the shoulder and plasty of the elbow is performed it then devolves upon the rotators of the scapula to produce inward and outward rotation by movement of the scapula in the sternoclavicular articulation. This again is the function of the rhomboid, trapezius, and serratus; and here is another instance of the intimate relation between elbow and shoulder girdle movement.

PROBLEM III. PRONATION CONTRACTURE

Most of the cases were of the spastic paralytic type. There were 42 operations. The types of operation were resection of the pronator teres and quadratus, tendon transplantation of pronator radii and flexor ulnaris to the dorsum of the forearm.

Finding frequently the older procedures of resection of the pronator and also that of transplantation according to Tubby insufficient, a later procedure of tendon transplantation was devised which provides for better mechanical and dynamic conditions.

With the elbow extended the total supinatory power is greatly in excess of that of pronation; with the elbow flexed it is merely equal to the total pronatory power. The principal supinators are biceps and supinator brevis, not considering the brachioradialis which is only a conditional supinator, that is, from an extreme pronation position. Extensors of thumb, wrist, and finger are secondary supinators of comparatively small power. Under ordinary conditions the tone of the pronator radii teres alone is sufficient to counteract the supinatory action of the biceps and supinator brevis. This can be seen from the fact that in certain fractures of the radius above the insertion of the pronator the upper end of the fragment is carried into full supination by the action of the biceps and supinator brevis, but when the fracture of the radius occurs below the insertion of the pronator teres a mid-position of forearm is maintained. We understand now why spastics, in order to effect supination, will extend the elbow, for thereby they facilitate outward rotation of the humerus and also give the supinators a position of preponderance over the pronators. By using the combined radii teres and the much stronger flexor carpi ulnaris and leading both muscles over the outside of the ulna to the back of the forearm and then diagonally to the outer side of the radius, we obtain a much better leverage and consequently much better supinatory power of the forearm.

Shall the pronator quadratus be sacrificed by myotomy or not? This depends entirely upon the degree of the pronation contracture. In most of the cases I found it advisable to leave the muscle intact as it is necessary to maintain the muscular balance between pronator and supinator group.

Restoration of pronatory and supinatory balance is one of the most difficult tasks in spastic cases. It requires not only primarily a good dynamic and mechanical muscle arrangement but also a great deal of painstaking and persistent muscle education.

In the interest of the muscle dynamics of the finger one frequently is not at liberty to stabilize the wrist in suitable position but must allow it to follow its own inclination to go into flexion. Such a situation naturally makes the question of pronatory and supinatory balance, so important for the use of the hand, still more complicated.

PROBLEM IV. STATICS AND DYNAMICS OF THE WRIST JOINT

In cases of paralysis of the muscles of the wrist joint I have on previous occasions pointed out that there are two ways of restoring balance and power. One is the transference of power by tendon transplantation, the other is the stabilization of the wrist by arthrodesis. In a large group of cases a combination of arthrodesis and tendon transplantation is indicated. As far as the wrist is concerned its stability is a necessity, and mobility of the wrist without stability represents a very doubtful advantage.

In musculospiral paralysis of wrist and fingers, tendon transplantation may procure both stability of the wrist and mobility of the fingers.

In infantile paralysis, where the stricken field is usually much larger, the mobility of the wrist must often be sacrificed in favor of complete and reliable stability. The elimination of wrist motion also opens the possibility of making use of flexors and extensors of the wrist, now becoming available for transplantation to the paralyzed extensors or flexors, respectively, of the fingers. These are, however, only general principles. Operative plans are so susceptible to changes according to the individual merits of the case that it appears necessary to go deeper into a mechanical analysis of the situation, which ultimately could determine the details of what operative procedure, if any, is suitable for the individual situation. Starting from the so-called position of rest which the wrist assumes when no muscle is especially innervated, a position given by the equation in which the momentum of all flexors at rest equals that of all extensors at rest, we find that this position does not represent the position of the wrist in which stabilization is to be desired. It is not the one in which the dynamic conditions are at

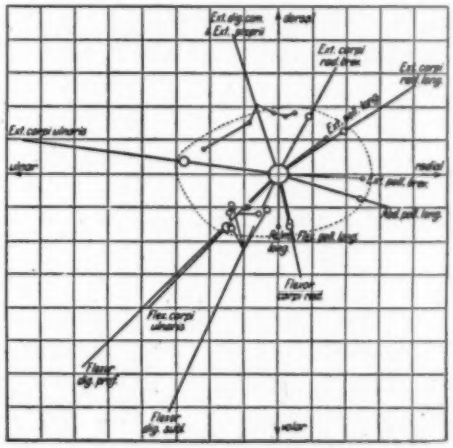


Fig. 2. Diagram showing dynamic relations of flexors and extensors of wrist and fingers.

their optimum; it is not the position the hand automatically assumes when attacking a strenuous task. With wrist flexors and extensors innervated, however, we find that the dynamics equilibrium between the weaker flexors and comparatively stronger extensors of the wrist joint is established only when the wrist goes in position of slight hyperextension. This we may call the position of action; in this position the momentum of extensor and flexor groups is equal in the state of innervation and this position is the basis of all display of power in the fingers.

If we further study the diagram of the muscles moving the wrist we notice that the balancing of the muscle groups against each other does not occur in the direction of flexion and extension only; there is also a balance of muscle power in regard to ulnar and radial abduction and, what is

more, there is a pairing of muscles with a mutual balancing in diagonal planes as well. (Fig. 2.) We note, for instance, the different behavior of the two musculi carpi ulnaris. The extensor is almost exclusively an ulnar abductor, but the flexor is a flexor as well as an abductor in equal measure.

A B

FIG. 3. Tendon transplantation of flexors of wrist to extensors of fingers and thumb. A. Spastic paralysis. B. Musculospiral palsy.

We note the antagonistic pairing of the extensor carpi ulnaris and the abductor pollicis longus, acting in exactly opposite directions in diagonal planes. We notice further the pairing of the flexor carpi radialis with the extensor of the fingers; the pairing of the extensor carpi radialis brevior with

FIG. 4. Tendon transplantation in musculospiral paralysis.

the flexor digitorum communis, the longior with the flexor carpi ulnaris. In this antagonistic arrangement we note that the direction of the muscle pull is at angles both with the anteroposterior and the transverse axis of the wrist joint. We note especially that the extensor carpi radialis muscles function as assistants to the closing of the fist since the direction of their pull is exactly opposite to that of the long finger flexors. Of these two, the extensor carpi radialis brevior is the more important in the action of the closing of the fingers owing to its insertion at the base of the third metacarpal which is more in the axis of the hand; the extensor carpi radialis longior which is inserted into the second metacarpal bone is only a secondary assistant to the closure of the fingers. So we see that balancing arrangements are made in all possible axes for the benefit not only of lateral and anteroposterior motion but of diagonal motion as well. To stabilize the wrist against motion in all these different directions is a very exacting problem and it is much more difficult to solve by tendon transplantation than by arthrodesis. (Fig. 3.)

PROBLEM V. FINGER ACTION: GRIPPING, FIST-MAKING, RELEASE

Even after the biological requirements of gliding and embedding and the mechanical requirements of direction and anchorage have seemingly been satisfied the expected muscle action often fails to develop.

A number of these unsatisfactory results can be explained by what is called active insufficiency of the muscles. Let us take the case of inflammatory or paralytic contractures of the flexor muscles of the

fingers and forearm. The muscles being shortened to their limit it is obvious that no further contraction can be displayed and the fingers remain in whatever position of flexion they have assumed. The muscle has accomodated itself to the length to which it has been placed. The usual expedient of lengthening these muscle units by lengthening the tendon might be useful where structural shortening of the muscle itself is only slight and where the muscle can still further accomodate itself to the change in its dynamic condition. In the ischemic contracture of Volkmann or in severe cases of spastic flexion-contractures of the wrist where a maximum contraction of the muscle bellies or a maximum shrinkage exists, lengthening of the tendon of these muscles cannot relieve the condition because it changes nothing in the condition of the muscle belly. It is quite obvious that in all these conditions conservative treatment by splints and manipulation must have the precedence because it actually lengthens the affected muscle. According to our best observers the length of the muscle at complete rest is double that in complete contraction. The principle of passive stretching of the muscle is exactly the one which Jones applies in the treatment of ischemic contracture. Cutting or lengthening of the tendons of the finger flexors so weakens their action that the ultimate result of any sort of indiscriminate tendoplasties can produce nothing but a cosmetic effect. Therefore we should refrain from interferences with flexors of the fingers and of the thumb and stress the conservative treatment by splints and manipulation to the utmost. It is quite a different matter with the flexion of the wrist. If the frequent contracture of the carpi ulnaris in Volkmann's contracture or in spastic cases cannot be overcome by manipulation or splint treatment, I do not hesitate to lengthen these tendons because we gain by it that physiological hyperextension position of the wrist which is so necessary a basis upon which finger action must be developed. But neither in ischemic contracture nor in spastic cases do I believe in the tenotomies or in the plastic lengthening of the finger flexors with the occasional exception of the long flexors of the thumb.

In spastic cases we have also learned to avail ourselves of what may be called the passive insufficiency of the extensor tendon. With the wrist in flexion the tendons are held in the state of tension which conveys to them a certain amount of power against the action of the finger flexors. The patient can avail himself of the elastic pull of these passively insufficient extensor tendons. When he wishes to release the closed fingers he carries the wrist in further flexion and the increased passive tension of the extensor tendons will separate the fingers. Because we think that this mechanism is extremely useful in spastic cases and one upon which the patient strongly relies for the play of his finger action we often refrain from stabilizing the wrist in hyperextension; and an indication for the latter operation should never be made until one is sure that the feature of passive insufficiency of the extensor tendon is not needed for the release of the finger grip.

PROBLEM VI. DISABILITIES OF THE THUMB

1. *Thenar Palsy.* Since the opponens is inserted in the radial side of the first metacarpal while the flexor brevis goes to the radial side of the metacarpophalangeal articulation, it follows that opponens action of the thumb is regularly combined with a somewhat pronatory longitudinal torsion of the metacarpal. The abductor participates especially at the beginning of the opposition movement without any particular rotatory effect upon the metacarpal. Opposition is initiated first by abductory and pronatory movement executed by the short flexor and opponens; then follows opposition movement, and the whole swing is finally finished by adductory movement carried out by the adductor and the ulnar head of the flexor brevis. All muscles, therefore, combine in the performing of the opposi-

tion movement of the thumb. Of especial importance are the radial head of the short flexor and the opponens pollicis.

Thenar palsy leaves a definite deficiency of the thumb which cannot well be substituted by any of the long muscles. When the median innervation is gone, two and one-half of the muscles of the thenar eminence are out of commission; such a deficiency cannot be made up by the remaining one and one-half muscles, that is, by the abductor and half of the short

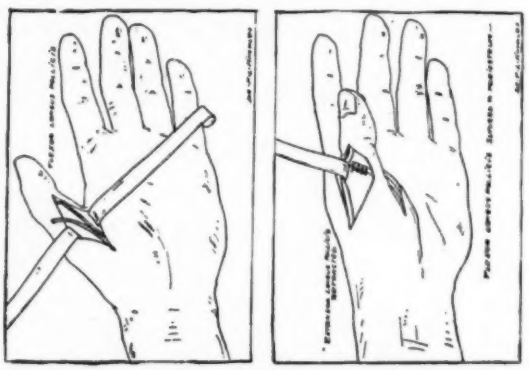


FIG. 5. Flexor plasty of thumb. Author's method.

flexor alone. In this situation I avail myself of a muscle plasty upon the long flexor of the thumb by which the radial half of this tendon is led around the base of the basal phalanx of the thumb and is here fastened to the periosteum (Fig. 5). It so forms a ligamentous check, the direction of which is very much in line with the pull of the opponens and the radial half of the short flexors. Nye uses the tendon of the abductor pollicis longus, leading it underneath the annular ligament and giving it a direction very similar to that of the opponens. I have applied both methods and found them very useful.

2. *Inability to Extend.* This is a very disturbing factor in spastic conditions. The thumb is slung under the fingers in an attempt to close them so that gripping or the picking up of objects is made impossible. We meet this situation by an operative procedure devised by Biesalski and Mayer; it is in principle a check operation performed upon the long extensors of the thumb; the tendon of the extensor of the index finger is used for anchorage to the long extensor of the thumb after the latter is given the best possible tension. Flexion of the thumb now meets with an increased obstacle and is retarded sufficiently to allow the fingers to close before the thumb has a chance to be caught underneath them. While this method does not exactly procure a dynamic equilibrium it is a very effective check to the precocious flexion propensity of the spastic hand. Sometimes this check proves too strong and then hyperextension in the metacarpophalangeal joint develops. When this occurs a plastic operation upon the tendon and the capsule becomes necessary. Sometimes one has to resort even to resection of the metacarpal head.

AFTER-TREATMENT

1. *Splints.* We have learned to appreciate the fact that in the after-treatment of operative reconstruction work of the upper extremity generalization is impossible. We may use certain typical splints to overcome pronation contracture or others to correct flexion contractures of the wrist, or those of the elbow, or the adductor contractures of the shoulder joint, etc. But with the exception of very simple situations, such as fusion of the shoulder joint, there are few situations in which one splint alone is found sufficient; in most cases splints of various types had to be applied not in succession but in alternation. A great deal depends upon the judicious choice of splints and upon their proper construction and application. For instance, in ischemic contractures, the stretching of the fingers, the straightening of the wrist, the developing of the gripping power and the relief of pronation contracture, all have to be attempted at the same time and all require a different type of splint.

2. *Massage and Mechanical After-treatment.* Massage and active motion should, as a rule, wait no longer than operative wound healing requires. Massage greatly enhances active motion by increasing the

muscle tone. In addition, there ought to be recommended warm bath or whirl spray before and after active movement. It goes without saying that active exercises should be of the simplest kind and precision and speed should be acquired for one motion or movement before a more complicated one is undertaken.

In tendon transplantation of the flexors to the extensors consideration must be given to the difficulties that arise from the inversion, or change, of muscle function. They are not as great as might be anticipated. The transplanted flexors, for instance, are never inactive in extension under normal conditions, nor are the transplanted extensors inactive in flexion, so that the converse tasks which the muscles are made to perform are not, after all, entirely alien functions. There is a certain amount of volitional block, however, which is sometimes rather hard to overcome, and which requires a good deal of patience and perseverance.

3. *Muscle Reeducation.* Nothing particular is to be added to what already has been said in regard to systematic muscle reeducation. We base our system of muscle reeducation upon the use of standard objects and the employment of certain stereotype motions. The quality of the work performed is gauged by relating these movements to the time it takes for their performance. We found that a certain number of cases in which muscle efficiency was routinely investigated before any further treatment was undertaken, showed a proficiency block at a certain point; when this block registered repeatedly in several readings and at different times, it could be assumed that a constant and definite physiological cause existed for it. Such a cause may lie in a particular type of disability, such as described previously, or it may be of some other nature, and arise from a situation which is still obscure and for which we consequently know of no surgical remedy. But in so far as these disabilities concerned situations known, such as those related in this paper, we have often been able to relieve the impediment, and procure further proficiency of the hand by operative methods. This was the case especially in the described disabilities of the thumb, of the forearm, etc. We feel, therefore, that the systematic testing and charting of functional ability upon the lines indicated not only gives us a conception of the progress made under treatment, but it also serves as a guide to indicate certain definite and very often surgically remediable disabilities.

THE SUPRATROCHLEAR FORAMEN
CLINICAL AND ANTHROPOLOGICAL CONSIDERATIONS

I. SETH HIRSH, M.D.

NEW YORK

IT is not without considerable hesitancy that I venture to present, before a gathering whose aims are as practical as this one, a study of a single anatomic variation in the morphology of the lower end of the humerus. I have been moved to do so, however, by several considerations:

First, it is an anatomic variation which in these days of abundant roentgenization is not infrequently seen, though rarely if at all noticed.

Second, its presence has some bearing on the functional capacity of the elbow joint.

Third, it must receive consideration and its significance must be appreciated when there is a history of trauma, particularly when a fracture of the lower end of the bone has resulted.

Fourth, it is of interest from the standpoint of man's philogenetic relationship. It is one of the many markings which permits the anthropologist to study the molding effect of the countless ages of struggle on the part of the man, to attain his present anatomic form.

In the evolution of man the condylar portion of the lower end of the humerus has undergone considerable modification. If the position of the elbow-axis is studied by measuring the condylo-diaphyseal angle, formed by a tangent to the trochlea and the axis of the diaphysis, a marked difference between the old and recent man will be found.

In the Neanderthal man, the trochlea is practically horizontal, while in modern man its axis is oblique.

With the change in the axis there have been structural changes in the trochlea, particularly in the development of the coronoid and the radial fossae.

	CONDYLO-DIAPHYSEAL ANGLE
Swiss average	77°
Bajuvares	78.5°
Swabians and Alamans (Bavarian)	80.2°
Alamans of Switzerland	80.5°
Terra del Fuego	83.0°
Senoi	83.7°
Paltacalo-Indians	84.5°
Homo Neandertalensis	87°

In the Senoi both fossae are practically alike, and the bony ridge that separates them runs directly downward in the axis of the diaphysis. In the modern Europeans the ridge deviates externally. Because of this, the coronoid fossa has come to lie practically in the center of the bone, just above the trochlea, while the radial fossa is lateral to the central axis of the diaphysis. The coronoid fossa is moderately deep while the radial fossa is very shallow.

During flexion of the forearm the coronoid fossa receives the coronoid process of the ulna. Posteriorly, there is the deep triangular depression, the olecranon fossa, in which the summit of the olecranon is received in extension of the forearm. These two fossae are separated from one another by a thin, more or less transparent lamina of bone, lined in the fresh state by the synovial membrane of the elbow joint.[1]

The plate of bone separating the coronoid and olecranon fossae may be perforated. This opening is called the supratrochlear foramen. It is a more or less oval or elliptical opening with a smooth margin

[1] The margins of the fossae afford attachment to the anterior and posterior ligaments of this articulation. Under cover of the transverse fibers of the posterior ligament, which forms a strong band bridging across the olecranon fossa, there is a pouch of synovial membrane lining the fossa and a large fat pad which projects into the upper part of it and is pressed into the fossa by the triceps.

and sloping edges with the long axis transverse, about 5 to 9 mm. wide and 3 to 4 mm. high. It is located above the epiphyseal line and is in the intra-articular part of the olecranon fossa below the line of reflection of the synovial membrane which crosses the middle of the fossa.

When large, the hole is actually in an open state, when small it may be covered by a membrane. When the bony septum is intact it contains several small perforations.

Most of the older anatomists, Braus, Renle, Seppey, Testus, mention this variation. Market calls the opening the supracondylar foramen.[1]

Fig. 1. Two left humeri, one with perforation and one with intact septum. Old Egyptian.

The supratrochlear foramen is not present at birth. In young individuals the bony septum is relatively thick. According to Hultkrantz, it may be 4.4 mm. thick in the newborn. The septum is gradually absorbed during childhood, producing the foramen which has not been observed before the sixth year.

The supratrochlear foramen is found only in mammals, both in the lower and in higher orders. It is absent in swimming and flying forms and in terrestrial forms adapted to life in the water. It is inconstant in various species and its absence or presence cannot be taken as an index for the species since there may be individual variations. But when specimens of several species of the same genus show it, its general occurrence in the species, if not in the genus, is a justified assumption. Among the marsupials it is found in the permeles; among the ungulates, in the wild pig, hyrax and others. Some of the beasts of prey, hyena, wolf, jackal and various insect eaters, have this characteristic.

As in man, so in the lower animals, the humerus is imperforate in the embryonal stage. The perforation is frequently found in semi-apes and apes.

Fig. 2. Left humeri with well-marked supratrochlear foramen. Ancient Indians of Salt River Valley.

Darwin mentions this foramen in the human as being one of the characteristics that show his close relationship to the lower forms. He states that it occurs, but not constantly, in various anthropoid and other apes, in full-grown gorilla, orang and chimpanzee. In the gibbon no supratrochlear foramen is present in infancy.

Anthropologists have studied the frequency of this foramen in various groups of people. The percentage of its occurrence varies greatly. Martin claims that this characteristic is relatively rare in late Europeans, but is commonly present in the neolithic and the prehistoric types, and the statistical data which he has tabulated seem to indicate the greater frequency of the foramen in ancient primitive people. It has been found in the humeri of skeletons from the caverns of

[1] This name is now reserved for a foramen formed above the median epicondyle, by a complete osseous or fibrous bridging of the supracondylar process to the median epicondyle. This foramen is present in many mammals and reptiles. The supracondylar process may be associated with the supratrochlear foramen as in Figure 6. This supracondylar process is fairly common in man though the foramen is rarely found.

Montmaigre, the sepulchre of Chelles and the excavations of Chamont wherein were the men of the Stone Age. The highest frequencies appear to be in the Veddas (58 per cent), an ancient primitive people of the jungle of Ceylon whose humeri even when not perforated show a very thin septum according to the excellent observations of the brothers Sarasin, in the primitive Arkansas Indians and in the Egyptian humeri taken from old Libyan graves.

PERCENTAGE OF OCCURRENCE OF SUPRATROCHLEAR HUMERAL FORAMEN (MARTIN)

1.	Veddas	58
	Arkansas-Indians	58
	Old Libyans	57.2
2.	Saladoans	53.9
	Old Mexicans	52.4
3.	Andaman	48.5
	Paltacalo Indians	44.4
4.	Guanches	39.5
	Louisana Indians	38.5
5.	Polynesians	34.3
6.	Negrito	33.3
	Lower Californians	32.3
	Mound Builders (Indians)	31.2
	Nialithies of Cave-aux-Fees	25
7.	Swabians and Alamans	23
8.	Neolithics of Montigny-Esbly	22
	Negroes, African	21.7
	Peruvians	20.8
9.	Cibola Indians	19.6
	Calcuaqui	18.4
	Bajuvaren	15.3
10.	Melanesians	14.1
	Japanese	13
	Terra del Fuego	11
	Italians	10
	Sardinians	9.4
	Old Patagonians	8
11.	Aino	7.9
	Bohemians	7.7
	Parisians (4th to 12th centuries)	5.5
	White Americans	4.2
	Parisians (Middle Ages)	4.1

1. Primitive people of the Ceylon jungle.
2. Indians of the Salado or Salt River Valley.
3. Inhabitants of islands, near the Bay of Bengal.
4. Canary Islanders.
5. Inhabitants of Polynesia and Melanesia.
6. Pigmies of the Oceanic Islands.
7. Swabians: Southern Germans, Early Christian era. Alamans: Former tribes inhabiting the lower Rhine, Bavaria and parts of Switzerland.
8. Men of the Stone Age.
9. Ancient Indians of the Zuni Valley.
10. Inhabitants of islands east of Australia.
11. Aborigines of Japan.

The lowest percentage is given by the Parisians of the Middle Ages, and white

FREQUENCY IN PERCENTAGE OF SUPRATROCHLEAR FORAMEN ACCORDING TO SEX AND SIDE (MARTIN)

	Sex	
	Male	Female
Guanchen	32.0	42.0
Andaman	31.2	53.8
Lower Californians	16.7	64.7
Japanese	7.3	28.1
Aino	5.6	22.2

	Side	
	Right	Left
Paltacalo Indians, male	36.4	41.2
Paltacalo Indians, female	41.9	56.0
Salado-Indians	44.1	63.0
Egyptians	36.2	47.8
Lower Californians	23.5	42.9
Mound builders	20.0	37.0
Calcuaqui	18.7	36.4
Negro and Mulatto	18.1	44.4
Schwaben and Alamannen	17.2	28.1
Malays	13.0	21.7
Peru	8.3	33.3
Cibola Indians	6.7	32.2
Whites	3.7	11.5

Americans. Hultkrantz found the foramen in 4.7 per cent of 150 recent males' arms of Swedes, in 14.8 per cent of 54 females, in 15.4 per cent of 52 humeri from the Stone Age, in 0 per cent of 59 humeri of Lapps.

From the data one is also permitted to infer that the characteristic is not confined to any one race, and that it has greater frequency in the female and on the left side.

The question naturally arises, of what significance is the foramen? Why is it disappearing from the humeri of modern men? Why is it more frequent in the female and on the left side? If it can be proven that there is any relationship between the presence of the foramen and an increase in the flexion and extension amplitude at the elbow joint, its significance would be apparent. It would then mean that there has been an adaptation to functional needs and that, on the whole, modern man has lost to a certain degree the range of these particular motions

possessed by his prehistoric ancestors and animals in whom this foramen is a more or less constant finding; and that this character is in recession and will eventually disappear. The little motion modern man has lost by this change has, of course, been more than compensated for by the general greater latitude of motion in other directions, made possible by greater obliquity of the condylar portion than exists in primitive man and animals.

It is true that the foramen appears to be associated with an increase in the amplitude of the extension movements in the joint. This is only slight in the fully formed joint, for the extent of the extension movements of the elbow are then affected by the ligamentous and muscular structures. But in one case of bilateral foramen (W. H., aged twelve years) hyperextension was marked. The foramen cannot be important and essential from this viewpoint because of its great variability, both in animals and in man.

Fig. 3. P. McC., male, aged nine, right arm. Supratrochlear foramen and old oblique fracture of the external portion of the diaphysis through the foramen.

Matthew and Lamb, in a study of the humeri of an ancient tribe of Indians of the Salt River Valley, the Saladoans, whose remains were found in mounds which also disclosed an old civilization, were struck by the frequency of this foramen in the adult and adolescent. Since the perforation was found in adolescents but not in infants, they considered it plausible that the foramen was acquired, not inherited. They concluded that the foramen resulted from mechanical pressure due to strenuous extension movement of the arm. In the particular group it was the activities of corn grinding by means of larger and smaller stones held in the hands of the operators, to which they ascribe the cause of this foramen. Such labor is of course common among the aborigines of the southwest, both ancient and modern, the females of the modern pueblos being engaged during the greater part of their time in grinding corn, a task they begin to perform while young. The higher frequency of the foramen in the females than among the males was explained on this basis. They accounted for its preponderance on the left side by supposing that the left arm is more frequently and forcibly used than the right, in this particular labor.

Fig. 4. D. B., male, aged ten. Supratrochlear foramen, double, the left side larger than the right. Evidence of old fracture of external portion of diaphysis.

These ideas are given at length in order to show how ingenious though entirely fallacious is reasoning and deduction when based on insufficient data and evidence. The presence of this perforation (as disclosed by the roentgen-ray examination) in living individuals of different nationalities, both children and adults, who have not indulged in any extraordinary muscular movements, is sufficient to demolish any hypothesis based on the theory of trauma.

The process of absorption is undoubtedly

associated with and influenced by modification of the blood supply. The nutrient vessels, which are chiefly supplied from the inferior profunda, enter this portion of the bone by nutrient foramina which are intra-articular, visible in radiographic

FIG. 5. F. K., aged sixteen. Left supratrochlear foramen. Note the two tubercles, one on the anterior external aspect, and one on the posterior internal aspect of the foramen.

studies in the upper contour of the foramen, one on either side.

At about the seventh year the ossification of the trochlear epiphysis begins and the growth of this part of the bone proceeds rapidly. It is at this time that the bony plate between the coronoid and olecranon fossae becomes cribriform, lamellar atrophy begins, the intralamellar spaces enlarge and absorption finally takes place of the central part of the septum.

It may be that the formation of the foramen is a phenomenon secondary to incomplete and insufficient vascularizations which, as evolutionary development proceeds, has become corrected and compensated for. The greater frequency in the female and on the left side may be explained by the hypothesis that the female humerus and the left humerus are, as a rule, somewhat less developed than the right. The factors may contribute to make the bony septum on the left side thinner than the right. Schinz states that the foramen is an hereditary characteristic.

The anatomist, zoologist and anthropologist all have shown an interest in this foramen and it is surprising that the roentgenologist, whose opportunities for studying living material permit him to contribute valuable data, has concerned himself so little with the subject. The foramen has not only a theoretical but also a practical bearing because of the frequency of fractures in this portion of the bone. It might

FIG. 6. E. C., female, aged twenty-three. Left supratrochlear foramen. Note the supracondyloid process, a sharp spur formation above the median epicondyle.

seem that in the presence of this foramen greater difficulty might be experienced in getting perfect anatomic and functional restitution.

An increase in illumination of this area is seen under normal conditions because

FIG. 7. J. J., male, aged fifty. Large supratrochlear foramen containing ossicle. Productive arthritic changes.

of the comparative thinness of this portion of the bone, but all lamellar markings must be absent and the foramen must be ringed with a thin edge of compacta, for the correct diagnosis. The foramen is usually oval except when deformed as a result of frac-

ture (Cases I and II) (Fig. 3). The long axis is parallel with a line between the epicondyls. The oval contour is normally modified by the presence of small spurs, one on the upper and inner, and one on the lower and outer contour of the foramen, a conformation similar to that which exists in the gorilla. The roentgen-ray studies of the living would indicate that it is frequently double and always larger on the left side.

The frequency of a fracture through the lower one-quarter to one-half inch of the diaphysis in children under six may be explained by the existence of the foramen. It is rare for epiphyseal separation to take place. Though the very elastic nature of the epiphysis plays a part in its preservation, it is the weakness of this portion of the bone because of the thin septum or foramen getween olecranon and coronoid fossae which predisposes it to fracture.

In supracondyler fractures where the line of fracture extends through the region of the foreman, the indented edge of the foramen may be made out in the lower fragment.

Above the olecranon there is sometimes present a detached rounded ossicle, the sesamum cubiti (Pfitzner). Cases VII and VIII (Fig. 7) show this rather large rounded nucleus of bone. It appears to lie within the foramen, the edges of which are considerably thickened. It is not to be mistaken for the center, or centers (two to three) of ossification of the epiphysis showing through the supratrochlear foramen. These appear from the tenth to the thirteenth year and fuse from the sixteenth to the twentieth year.

As a rule, this ossicle is seen well behind the humerus but because of the foramen it may come to lie within it, being pressed into this position by the triceps. If there are arthritic changes in the elbow, these sesamoids partake of the productive changes and may become very large. If the olecranon process is the analogue of the patella, this sesamoid may correspond to the suprapatellar ossicle.

SUPRATROCHLEAR FORAMEN

Name	Sex	Age	Weight	Right Arm	Left Arm	Fig.
P. McC.....	M	9	...	Regular	No film	3
D. B.....	M	10	75	Regular	Irregular	4
W. H.....	M	12	102	Regular	Regular	*
F. K.....	?	16	...	No film	Regular	5
A. S.....	M	22	175	Absent	Regular	*
E. C.....	F	23	...	No film	Regular	6
P. K.....	M	32	145	Regular	No film	*
J. J.....	M	30	...	Regular	No film	7

[* This and several other illustrations omitted to conserve space.—Ed.]

SUMMARY

1. The supratrochlear foramen should be looked for in the roentgenogram and noted, not only because of its clinical but also because of its anthropological interest.

2. It is not found before the age of six years and is usually bilateral.

3. It is more common in the female and is usually more characteristic and larger on the left sde.

4. It is an anatomical variation and must not be misinterpreted in injuries to the elbow.

5. An increase in hyperextension was found in association with a bilateral supratrochlear foramen in a child.

6. A spherical ossicle is described, probably the sesamoid cubiti of Pfitzner, which has been pressed into the foramen by the overlying structures.

RESULTS OF ORTHOPEDIC TREATMENT IN DYSTONIA

EDGAR D. OPPENHEIMER, M.D.

NEW YORK

DYSTONIA musculorum is one of a group of neurological conditions or symptom-complexes in which the clinical diagnosis is based on abnormal motor activity and in which the pathological lesion is in the motor nuclei of the extrapyramidal tracts. According to Professor Jacob of Hamburg degenerative changes have been found in the striatum, caudate nucleus and putamen, pallidum and the substantia nigra and nucleus ruber. The nucleus ruber acts as a relay for the fibers from the cerebellum and controls the functon of coordination and tone of synergistic muscles. It is here that the dominant lesion in dystonia is thought to exist. There is a dissociation in synergy among muscle groups and the tone which allows of orderly purposeful movements is disturbed.

The essential feature of this condition is alternation in tone of single muscles or groups of muscles resulting in quivering, twitching and spasms, and movements that are bizarre and different from any other movements. Because of their difference and similarity they may be compared with tics, choreas, spasms, tremors, convulsive movements, clonus, athetoses, etc. The voluntary movements of the patient take place with the dystonic elements superimposed. They are present continuously except in sleep and in narcosis. They can be diminished by voluntary control and are markedly influenced by psychical conditions. If intentionally decreased in one area they will be increased elsewhere. In that regard they differ from paralysis agitans.

In past years these cases have been described as hysterical conditions and it is only since 1908 that they have been recognized as a distinct entity variously designated as tonic torsion spasm, torti pelvis, dysbasia lordotica progressiva, etc. In 1911 Oppenheim, recognizing the essential element of abnormal tone, applied the term dystonia musculorm deformans, which is usually accepted. Epidemic encephalitis is known to be the causative factor of the degeneration in many of the cases and is the only known cause. Other encephalitic sequellae may complete the picture and elements of paralysis agitans and other physical conditions may coexist.

Most of the cases have begun in childhood. The onset is gradual. Several years may elapse before the condition is marked. At times it may seem to develop rapidly. It may become stationary just as other neurological conditions do that are the result of degenerative central lesions. Pathological examination may show no active lesion in the cerebrum in post-encephalitic cases. However, the result on the muscular system due to the constant twitching may lead to progressive atrophies, contractures and deformities. The condition is not fatal. Taken all in all it seems to be progressive. I know of only one case which I have observed for ten years in which I can speak definitely of improvement. This patient can now control his movements so that he earns his living; he can write; and last year he had sufficient control to drive a Ford car from Florida to New Haven.

Three cases in which the torsion and deformity were extreme were treated by prolonged immobilization in corrective plaster casts. The cases selected were the worst, those whose distorted positions

and deformities of motion tortured them excessively. Other cases untreated act as a control for us.

Case I. R. E. entered Montefiore Hospital September, 1921, aged seventeen years, with a history of encephalitis in September, 1920, and onset of twitching in the feet in December, 1920. She was able to walk when admitted but became progressively worse. In July, 1924, a cast to correct complete flexion contraction of one knee and hip was found impractical. The plaster on the lunar-shaped foot had to be removed early to prevent pressure sores. From September, 1924, to date she has been in a long double spica. Under anesthesia, the muscles relax but the contractures of the joints remain in part, depending on the duration and severity of the deformity. The knees and hips were straightened without undue difficulty but the feet were rather rigid and the deformity was therefore only partially corrected. She had marked adduction spasm of the hips. A long double plaster spica including both feet was successfully kept on several months at a time. On removal of the plaster the limbs went back to their former positions, the spasms causing intense pain. Reapplication of the casts required anesthesia and morphine. For two and a half years this procedure was maintained. The last spica was applied without narcotic or anesthesia. The patient has now been two months without plaster. The contractures of the knees and hips have subsided, the twitching and spasms persist but are diminished. The limbs are held rigid, the motions are limited, there is marked atrophy of the lower extremities, less so of the upper. There are no hypertrophies.

She had required morphine but has had none for some time. She is more comfortable than in previous years and claims to have been benefited by the plaster. (Fig. 1.)

Case II. J. S. entered Montefiore Hospital May, 1922, aged seventeen years. In January, 1920, there was onset of what was probably encephalitis. She had been at Mt. Sinai Hospital for observation for abdominal pains and mental depression and became noisy, excited and confused. Her dystonic course was more rapid than that in Case 1. Her extreme flexed position in September, 1922, led us to put her under anesthesia in a double spica. We kept her in plaster for one and one-half years. In a psychotic episode she became maniacal and unmanageable and we were forced to discharge her from the hospital. Since then she has been at the Metropolitan Hospital without plaster but she is given morphine to which she has become accustomed. Her condition today is much better than when she was at Montefiore Hospital. The severe contractures of the lower extremities are gone, the hips and knees have remained in extension. The feet still have the semilunar or varus position. A fine quiver or twitching is present in all the muscles, which is increased on extending the muscle. Voluntary motion is limited. A fair amount of atrophy is present in all the muscles. At times she gets attacks during which her knees and hips flex. About three years ago the operation suggested by Roy and Hunter, a separation of the sympathic fibers from the brachial plexus was done on the right side. It was followed by a total paralysis of that extremity and a gradual recovery. There is slightly diminished sensation over some areas of the arm, marked atrophy of biceps and triceps and hypertrophy of the hand flexors. The extremity is less rigid but not free from dystonia. She says the

Fig. 1. Case 1. Six weeks after the plaster has been removed, showing deformities of hands and feet and a distinct improvement in the position of the knees, hips and trunk.

Fig. 2. Case III. One month after removal of plaster showing a flexion-contraction of hips and knees and torsion of the trunk of a different pattern than at onset.

operation has improved her arm because now she can write while before she could not.

Case III. Admitted to Montefiore Hospital in 1920, aged nineteen years. No history of encephalitis. Had attacks of emotional instability, turned her feet involuntarily into varus, wore plaster and braces. She improved and was discharged after a year and a half in the hospital. Neurologists doubted the existence of any organic lesion. Diagnosis, psychoneurosis. In July, 1924, after being out a year she was readmitted with well-marked dystonic movements of hands and feet. In December, 1925, she suddenly started with extreme flexor contracture of knees, hyperextension of thighs and lordosis. From February, 1925, to within a month ago she has been in plaster casts in corrected position. She claimed to be more comfortable that way. She has had periods of circulatory disturbance which forced us to open the plaster casts; but we were able to continue them. The flexion of the knees and thighs has returned in part, is less severe and painful and under better control.

These cases are from the neurological wards of Montefiore Hospital and the service of Dr. S. P. Goodhart to whom I am indebted for permission to report them and for the use of his moving pictures. These latter are a part of a large and extensive series made by him for study of motion and for teaching. It was at his instigation that these attempts were made to relieve an unbearable condition. We knew that it was impossible to keep a plaster cast on a foot on account of the small surface for pressure and the strength of the muscles. For a thigh and a knee and trunk correction we have larger surface and greater leverage and were able to maintain the splints without any pressure sores these several years. The cause of the disease, being a lesion of the central nervous system, could not be modified by our work. The object was to prevent severe deformity and to relieve the patients from a worse condition. It is only applicable in certain severe cases involving the thighs and trunk. I do not recommend it for the foot, hand or neck. My main objection to the procedure is the morphinism which resulted and which we later cured in two of the three cases. There is no treatment by drugs or nerve-cutting operation that can be considered. In favor of the treatment is the feeling and opinion of the patients. They claim to be helped. I am inclined to discount their statements, but even so, they should be given consideration. I was rather opposed to the procedure all along but when I look back and analyze each case dispassionately I must confess they were helped. Unless we intend to carry this out to a logical conclusion and keep the casts on continuously for years we should not begin; a few months only makes matters worse. Anesthesia and morphine are necessary and only the extreme cases should be considered.

Atrophy exists in my three cases. It exists in the other cases also even if not marked. It is an advantage to the patient. When the muscle action is slight we see hypertrophies; when it is excessive we see atrophies. I think the muscles get worn out from overstimulation and inability to get rest. I was disinclined to report these cases but I feel it is my duty to do so, that the work should not be done again from an experimental point of view, and that the limitations to this treatment be better known.

PRESENTATION OF CASES

POSTOPERATIVE RESULT IN A CASE OF DISLOCATION OF THE ANKLE WITH FRACTURE AND AVULSION OF THE HEAD OF THE ASTRAGALUS

CHARLES OGILVY, M.D.

R. H., aged nineteen years, when coasting while seated on a sled with her feet forward, ran into an automobile at the foot of the hill. The impact was so sudden and severe that she does not know what happened in the collision. When picked up she was unable to stand and was taken to the hospital.

An hour after her admission I saw her and the roentgenograms taken at that time showed

a fracture-dislocation of the left ankle, the foot being dislocated outward and the dislocation taking place at the tibio-tarsal joint. (Fig. 1.) The films also disclosed what appeared to be the upper portion of the astragalus

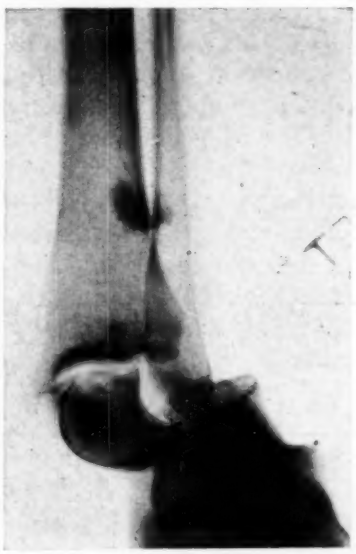


FIG. 1. Fracture-dislocation as it appeared immediately after the accident.

outside of the capsule and lying beneath the skin on the inner side of the ankle. This, upon operation, proved to be the head of the astragalus, there being a fracture through the neck of that bone.

The patient was immediately taken to the operating room where, by extension, the lateral displacement was corrected. Another roentgenogram then showed the foot in better alignment, but not reduced as far as the ankle-joint itself was concerned, there being a space left between the articulating surfaces of the tibia and the astragalus.

An incision 3 inches long was made over the lower and inner border of the ankle over the prominence made by the displaced bone and sweeping around the front of the ankle joint. Much to my surprise, I found that the head of the astragalus was that which had broken loose and was protruding beneath the skin on the inner side just anterior to and below the malleolus.

The remaining portion of the astragalus had rotated so that the fractured surfaces of the neck were thrown upward instead of forward, and the body of the astragalus was carried forward against the surface of the scaphoid. This was replaced without great difficulty.

I then attempted to replace the head of the astragalus, but could not do so because of obstruction by the tibialis posticus. This was severed in an oblique direction, and the head of the astragalus was with some diffi-

FIG. 2. Postoperative result. Anteroposterior view.

culty replaced and fitted accurately in it normal position. (Fig. 3.)

The tendon was then reunited with No. 0 chromicized catgut and the head of the astragalus was retained in position by chromi-

FIG. 3. Postoperative result. Lateral view showing the fracture through the neck of the astragalus.

cized sutures through the periosteum. The apposition and fixation thus obtained were so good that drilling of the bones for deep ligatures was deemed unnecessary.

The wound was closed with chromicized catgut for the deep, and plain catgut for the

skin, sutures. The foot was put up at right angles with slight inversion and a plaster of Paris cast was applied.

Passive motion was begun in two weeks; active and passive motions were carried on in three weeks, and weight-bearing was allowed five weeks after the operation. In two months the patient was walking with but a very slightly perceptible limp.

There has been absolutely no trouble since. Perfect function has resulted, with not the slightest curtailment of any activities, such as dancing, skating, etc.

My object in presenting this patient's case is to emphasize first, the importance of treating these cases as soon as possible after the injury, and second, the all-important point of beginning active and passive motion early. This should be begun, in my opinion, as soon as it is possible to move the joint without severe pain.

THREE CASES OF FAMILIAL CLAWFOOT WITH ABSENT TENDON REFLEXES

CHARLES ROSENHECK, M.D.

These three cases are in one family, mother, daughter and son. The ages are, respectively, thirty-six, sixteen and eight years. They all present marked pes cavus and claw-foot with abolition of all the deep tendon reflexes of both upper and lower extremities. There were no sensory disturbances and practically no demonstrable atrophy in the distal parts of the involved extremities. The mother and son show no gait disturbances but the daughter walks with a "steppage" gait due to weakness of the dorsiflexors of the feet. She also shows considerable weakness of the grip in both hands. The electrical reactions are normal in mother and son but the daughter shows a qualitative and quantitative diminution to faradism in the weakened dorsiflexors of the feet. The Wassermann blood reaction is negative in all three patients. Lumbar puncture was not done.

The cases are typical of the Charcot-Marie-Tooth type of progressive neuromuscular atrophy with the notable exception that the progressiveness of the symptoms is apparently lacking, the affection involving the feet only, producing the typical foot deformity and assuming a stationary character. This has prompted Roussy and Levy of France and Symonds of England to consider them as a definite clinical entity. They have therefore proposed to designate these cases as "Charcot-Marie-Tooth neuromuscular atrophy (formes frustes)."

While it appears somewhat unnecessary to add nosological entities to an already well-recognized affection which obviously may show variations in the clinical picture or concept of the disease, the occurrence of such a distinct foot deformity with absent tendon reflexes in three members of one family is unique and worthy of classification.

PARALYTIC DEFORMITIES OF ELBOW AND WRIST: PRELIMINARY NONOPERATIVE CARE

WALTER TRUSLOW, M.D.

BROOKLYN, NEW YORK

This patient, with much deformity at elbow, wrist and hand, is presented to reemphasize that much can be accomplished in lessening deformity and improving function by mechanical means alone; and to state that it should be a general principle to accomplish as much as possible by mechanical means before operating. I beleive that a higher degree of final function is thus assured and that the operative needs are better understood after mechanical and reeducative means have restored what may be restored thereby.

This girl, A. O., aged twelve years, came to me a year and a half ago, with marked deformities and disabilities of the left elbow, wrist and hand. She was said to have been normal at birth. At two years of age she apparently had an attack of poliomyelitis, although the acute symptoms were so light that no diagnosis was made. There had been inadequate protective care of the parts involved, and she presented to me a flexed forearm, which was held in extreme supination, the distal radius being carried much lower than the distal ulna. The hand was carried down in reverse wrist-drop, the thumb being lower than the fifth finger. There was marked relaxation of the lateral ligaments of the wrist on the ulnar side, with much separation between the ulna and the ulnar carpus.

Examination showed a freely active flexion at the elbow, but an extension limited to 130 degrees and a faulty carrying angle. Believing

that there was no true bone block at the elbow, I determined to try a gradual overcoming of the extension limitation by plaster of Paris dressings and wedgings. The forearm could freely supinate and oversupinate but pronation was very weak as a voluntary act and was much limited passively. An examination of roentgen-ray films showed bowing anteversion of the lower 2 inches of the ulna, which seemed to account for the oversupination and the limited pronation of the forearm. I believed then and do now believe that this ulna deformity will have to be corrected by osteotomy and realignment, but I planned to see what the plaster of Paris dressings could do for this. There was a separation of nearly an inch between the ulna and the ulnar carpus. The hand was carried to the radial side and there was no ulnar flexion power. It was concluded that there were greatly stretched wrist ligaments on the ulnar side. The hand dangled in reverse wrist-drop and with the radial side lower, the palm forward. There was no voluntary power of thumb adduction or of finger flexion. It was planned that the plaster of Paris dressing should reverse the faulty carrying positions of the hand, the thumb and the fingers.

I outlined as much correction of deformity and restoration of power as possible by plaster of Paris dressings and bracing and by gradual muscle reeducation, and operation later to correct what was not correctible by mechanical means.

The first plaster of Paris dressing was applied in October, 1925. It extended from the left axilla to the finger tips. The elbow was held by the dressing at 130 degrees' flexion, the forearm in supination (not in the habitual oversupination), the hand was flexed and carried to the radial side, and fingers and thumb were flexed. At the end of one week, the first elbow wedging was done, an angle of 130 degrees was opened up to 150 degrees. At one week more, the second wedging brought the angle to 165 degrees. The faulty carrying angle was lessened in these wedgings.

The plaster of Paris dressing was removed four weeks after its application and the following improvements were noted:

1. Elbow can be straightened to nearly normal, with a fair carrying angle. No voluntary extension power observable.

2. Wrist does not reverse drop easily, but there was no voluntary flexion power. The hand was less radio-flexed.

3. Fingers can voluntarily flex weakly; thumb can adduct feebly.

It was judged time to begin muscle training, while continuing to protect and hold the improved positions. A posterior plaster of Paris splint was made, extending from elbow to finger tips, freeing the elbow, holding the fingers flexed, the thumb adducted and the hand radio-flexed. The patient was instructed to exercise the elbow as freely as possible and to remove the splint once a day for finger-flexion and wrist-flexion exercises, which were shown her.

For six months, this was the procedure, broken once by a two weeks' return to fixed plaster of Paris dressing, elbow to finger tips, to rest fingers and thumb in a flexed position. She was intelligent and faithful to her exercises, which were increased from time to time.

By April, 1926, six months after starting supportive and muscle-training care, there was much return of power in finger flexors and in thumb adduction. At that time a special brace was made, extending from axilla to finger tips. It has a free elbow joint, controlled by a stout elastic strap to aid extension. At the wrist there is a stop-joint allowing flexion only.

She has worn this brace since then, improving her elbow extension power, maintaining the hand in neutral, that is, preventing radio-flexion. By continued faithfulness in her special exercises and by persisting in using her left hand in daily school and home occupations, she has attained muscle power which she did not have a year ago.

A few days ago the results attained by mechanical treatment and muscle education were tabulated, as follows:

1. Elbow: deformities of flexion and of faulty carrying angle practically overcome, and beginning return of voluntary extension power.

2. Forearm: greater range of pronation and of voluntary pronation.

3. Wrist: reverse wrist-drop deformity nearly overcome, some degree of voluntary wrist flexion, approximation of ulna to ulnar carpus attained, with improvement of the bone of the ulnar lateral ligaments and with considerable voluntary ulnar flexion. (Improvement in the lateral wrist drop deformity has been delayed by the bowing deformity of the ulna.)

4. Thumb: much voluntary power in adductors.

5. Fingers: much voluntary flexor power.

It is now proposed to perform osteotomy of the lower end of the ulna, with realignment of the distal fragment and to reinforce the ulnar lateral ligaments with transplanted fascia lata. It is believed that this will make the hand much stronger. What to do for the weak elbow extensor muscles is not yet decided. Muscle reeducation will of course be continued.

It is repeated that, by delaying operation, this girl has attained much lessened deformity and much improvement in muscle control. The line of procedure by operative means is now much clearer than it was when first caring for the case.]

[SURGICAL SUGGESTIONS]

INTERMITTENT pain in the ear usually signifies a tubal condition. The pain of otitis media is constant.

PAIN in the ear is common after tonsillectomy and does not indicate an otitis.

MYRINGOTOMY performed too early, that is before the drum is actually bulging, carries the risk of infecting the space between the two layers of the drum and, therefrom, the mastoid cells.

COMMENT AND CORRESPONDENCE

INGUINAL HERNIOPLASTY

To the Editor:—

Your editorial on Inguinal Hernia (the JOURNAL, March, 1926) is, to say the least, a real analysis of this unsettled subject. There is already an array of authorities who agree with either Koontz or Seelig but, personally, I feel that I have seen union between muscle and ligament in a sufficient number of cases to convince me that Koontz is correct. However, I doubt if such union ever takes place in the presence of tension except where the muscle is immediately torn away, as I found in a double hernia in 1903 where silver wire had been used by Halsted. In this case the whole suture bite separated in a straight line and was firmly attached to Poupart's ligament when I operated for recurrence.

Hamilton Russell is undoubtedly correct in his views, based on thirty years' experience, but our own Oschner went further nearly an equal number of years ago, when he maintained that hernia in children could be cured by any procedure that kept the sac empty and said further that if ever operation is undertaken, the simpler the better.

We have had recurrent hernias here from many different parts of the country, sent by the Veterans' Bureau, and they represent the work of many surgeons who were in the service and some that were done after the War. Our greatest problem, of course, has been the direct type.

In a great proportion of these cases, the reformed sac would suggest that too much tissue for sac reformation was left at the original operation. Of course, every man doing much hernia work has his pet hernia hobby, and I am no exception to the rule; however, it has not gone to the point of thinking everybody out of step but me.

I have tried, during the past eight years, to improve on the results obtained in the eighteen years preceding that period, as mentioned in my last article on the subject and I feel that the results obtained by a combination of steps advocated by many have helped materially. They are about as follows:

Very complete eradication of the sac and the use of a purse-string suture introduced high inside the sac.

Careful obliteration of the abdominal ring after the purse-string method of Connell (of intestinal suture fame.)

Relaxation of the structures at the apex of the inguinal triangle by sutures in front of, rather than above, the pubic bone, as I described in *Annals of Surgery*, November, 1926.

Suture (as in Bassini operation) of internal oblique and transversalis to Poupart's ligament. I do this for support, as advocated by Bassini, and again to support the weak transversalis on the theory that such structures are stronger when supported by muscle.

The remainder of the operation is practically the Mayo utilization of the external oblique.

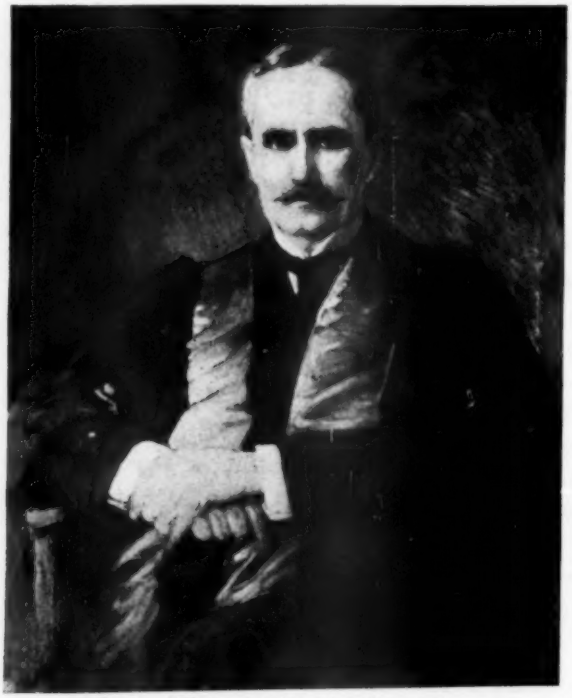
If facial strips are indicated they can be used with much greater ease if the tension sutures originally advocated are used.

WM. L. KELLER, M.D.

WALTER REED GENERAL HOSPITAL
WASHINGTON, D. C.
March 7, 1927

ROBERT FULTON WEIR

THE death on April 6, 1927, of the venerable Robert F. Weir of New York marked the passing of a conspicuous figure in American surgery. Born in New York in 1838, he was graduated from the Free Academy (College of the City of New York) in 1854. In 1859 he received his degree in medicine from the New York College of Physicians and Surgeons. He served as assistant surgeon in the U. S. Army throughout the Civil War and was in charge of a hospital at Frederick, Maryland, from 1862 to the end of hostilities. His later hospital and teaching positions in New York City added to his experience in the practice of pre-Listerian surgery. Both in that period and, especially, later, when antisepsis and then asepsis gave renaissance to surgery, he made many important contributions to his art and science. These touched on too many fields to list here, but perhaps he may be especially mentioned in connection with surgery of the joints and of the intestines. He was among the first to recognize duodenal ulcer as an entity. He made an important modification of the Murphy button for its use in gastroenterostomy. But his name is most often encountered in recent surgical literature as the inventor of appendicostomy. For many years he was attending surgeon at the New York and Roosevelt Hospitals. For several years, too, he shared with William T. Bull the professorship of surgery at Columbia University, and thousands of students took their inspiration, in lecture hall and operating room, from these two loved teachers.



Robert Fulton Weir (1838–1927).
(From a portrait by John A. Weir, Courtesy of the New York Academy of Medicine.)

In the retirement of his advanced years, still in the city of his birth and activities, he looked back upon a long life of surgical achievements that won him the recognition of many foreign and American societies.

In 1895 he was made a member of the

Société de Chirurgie de Paris. In the New York Academy of Medicine hangs this portrait, in oils, of its one time president, Robert F. Weir, wearing the gown of the Royal College of Surgeons of London, which in 1900 gave him the unusual distinction of conferring upon him its honorary fellowship. In the same year he became president of the American Surgical Association. When the American College of Surgeons was organized in 1913 he was one of five surgeons selected for honorary fellowship. At the time of his death he still bore the title of Consulting Surgeon to the Roosevelt, New York, St. Luke's and St. Vincent's Hospitals.

CHARLES HOWARD PECK

PROMINENT among American surgeons and generally admired, Dr. Charles Peck of New York died of pernicious anemia on March 28, 1927, at the age of fifty-six. He had been attending surgeon to the French Hospital and later, and for several years, to the Roosevelt Hospital, and was consulting surgeon to many hospitals in and about New York, and professor of clinical surgery, Columbia University College of Physicians and Surgeons.

Charles Howard Peck (1870–1927).

During the World War he was Director of the Roosevelt Hospital Unit (Base Hospital 15) in Chaumont, and served as consultant in general surgery both in the A. E. F. and later in the Surgeon General's Office. He was awarded the Distinguished Service Medal and was Colonel in the Medical Reserve Corps of the Army. He was a member of the New York Surgical Society and of the American Surgical Association, and had been chairman of the Section on Surgery of the American Medical Association and president of the Medical Society of the County of New York. He was perhaps especially interested in and best known for gastrointestinal surgery, and his operative clinics attracted visitors from many cities.

BOOK REVIEWS

THE TREATMENT OF FRACTURES. With Notes Upon a Few Common Dislocations. By Charles Locke Scudder, M.D., F.A.C.S., Consulting Surgeon to the Massachusetts General Hosp., Fellow American Surgical Association; Ed. 10, 8vo. Cloth. $12. Pp. 1240; 2027 illus., Phila. W. B. Saunders Co., 1926.

This splendid work, which has been before the profession for a quarter century, is too familiar to need extended review. In this tenth edition the treatise has been almost doubled in size. It has been increased in pages from 700 to 1200, and in illustrations from 1200 to 2000. Every part of the work has been thoroughly revised and much expanded. Thus, Operative Treatment of Fractures, which in the ninth edition was dismissed in a single chapter of 16 pages, now occupies six chapters of 160 pages. The short chapter on Pathological Fractures has been replaced by a longer one contributed by Joseph C. Bloodgood. There have been introduced also chapters on Bone Repair by Frederick W. Bancroft, on Birth Fractures based on the monograph of Edward D. Truesdell, and on Massage based on the monograph of James B. Mennell. There is a final new chapter on medicolegal considerations.

In its present form, Scudder's is much the largest, most complete and most modern, practical treatise on fractures in the English language. The spirit that appears to have guided the author throughout is to be found in his statements in the preface: "Rigid and strictly standardized methods of fracture treatment are undesirable and never can be developed. The variety of conditions attending a fracture will always compel the exercise of careful judgment in the choice of treatment.

MANIPULATIVE SURGERY. PRINCIPLES AND PRACTICE. By A. G. Timbrell Fisher, M.C., F.R.C.S. (Eng.); Surgeon, Seaman's (Dreadnought) Hosp., Greenwich. 8vo. Cloth. $3. Pp. 168; 62 illus. N. Y. Macmillan Co., 1926.

This interesting and very readable little manual might be regarded as a companion to the author's "Internal Derangements of the Knee Joint"; and, so far as that articulation is concerned, it covers some of the same ground. In the first chapter Fisher discusses the views of John Hunter, John Hilton, H. O. Thomas, Sir James Paget and Wharton Hood on rest and movement in joint affections, and in the second chapter he elucidates the varieties of conditions that respond to the manipulations of "bone-setters."

Most of this little book is given to manipulation of the knee and other joints of the extremities, but manipulative treatment of the spine is also included. Like Jones and Lovett, the author believes that subluxation of the sacroiliac joint as a cause of chronic backache has not been established. He emphasized that in the manipulation of dislocated meniscus of the knee, if the patient cannot fully and painlessly extend the joint, reduction has not been accomplished.

Indications, contraindications, technique and after-treatment are duly dealt with throughout. Fisher insists that manipulative surgery must be taught in our medical schools, and he adds: "Clinical lectures and demonstrations must be given at every hospital, for every out-patient department contains scores of cases which are 'crying out' for manipulation. Above all, there must be a fundamental change of outlook —a little more manly breadth of vision and of the true scientific spirit, and a little less of narrowness, pettiness, and of an attitude which condemns things because it cannot understand them, or because they are practised by persons outside the medical profession."

ORTHOPEDIC SURGERY. By W A. Cochrane, MB., CH.B., F.R.C.S.E., Asst. Surgeon, Royal Inf., Edinb. 8vo. Cloth. $6.50. Pp. 528; 504 illus. N. Y. William Wood & Co., 1926.

The author of this manual is co-author with Philip D. Wilson of Boston of a book on Fractures and Dislocations which, published two years ago, has been everywhere received with warm praise. Cochrane was a pupil of Goldthwait, whose views on posture and bodily mechanics he sets forth in Part 1 of this work, of Osgood, also in Boston, and of Sir Harold Stiles. The book is strictly a student's manual, and is correspondingly condensed. But it is a modern exposition of orthopedics and par-

ticularly valuable in that it emphasizes the mechanistic problems involved.

We note that the author makes mention of brachial plexus pressure by the first rib, a condition described first by his fellow-townsman, Bramwell, the neurologist, and treated surgically by Stiles, also of Edinburgh, but concerning which there has been exceedingly little in American literature.

The description of subdeltoid bursitis is in several respects faulty and appears to indicate a very limited experience with that affection. It gives the reader an erroneous impression concerning the significance and location of sometimes associated lime deposit and of its rational treatment.

Clinical Surgical Diagnosis for Students and Practitioners. By F. de Quervain, Prof. of Surgery and Director of Surgical Clinic, Univ. of Berne. Trans. by J. Snowman, M.D. English Ed. 4, 8vo. $14. Pp. 937; 750 illus., 7 pl. N. Y. William Wood & Co., 1926.

This is a translation of the as yet unpublished ninth German edition. As its title indicates, the work emphasizes clinical as contrasted with laboratory diagnosis. It bears the individuality of the author and both in its profusion of illustrations and in its text it reflects the large experience of this Swiss master of surgery.

Beobachtungen und Ergebnisse bei einer Fünfjährigen Frakturenbehandlung. (*Klinische und unfallmedizinische Feststellungen*). By Dr. Hans Scheffler, Assistenzarzt am Krankenhaus Bergmannsheil in Bochum. 8vo. Price, M. 3. Pp. 85; 18 illus. Berlin: Julius Springer, 1927.

This brochure appeared first in the twenty-fourth volume of the *Archiv für Orthopedische und Unfall-chirurgie*. It was written with the purpose of presenting accurate information on the etiology, the type of treatment and the total period of disability of the various kinds of fractures exclusive of fractures of the pelvis, the skull and the spinal column. Though the author's material was drawn entirely from a mining population subjected to the injuries common in mines, many of the conclusions reached may with confidence be applied to the fractures ordinarily seen in any large city.

The author lays particular stress on the importance of immediate treatment of the fracture as a factor in the early rehabilitation of the patient. Where traction was necessary, as in the case of fractures of the thigh or of the upper part of the arm, he apparently prefers skeletal traction to skin traction. In practically all types of fractures, the principle of "functional treatment" was adhered to rigidly wherever possible. This involves almost immediate institution of massage and mechanotherapy and the early active use of the injured limb. In cases treated in this manner, before the development of a firm bony callus, the author shows that the total period of treatment was seldom more than two or three weeks longer than the time required for the appearance of a firm callus. In this manner, the long periods of neurasthenic disability are avoided and the hopeful mental attitude of the patient is maintained. To achieve such results, it is the author's opinion that the fundamental principle of immobilizing both the joint above and below the site of a fracture must be completely disregarded and the use of circular plaster bandages must be completely discarded.

Organisation und Ordnungsgemässer betrieb des Operationssaals. By Prof. Dr. Max Kappis, Hannover. Paper. 16mo. Price, M. 4.80. Pp. 199; 28 illus. Leipzig: Georg Thieme, 1927.

As a result of his efforts in the construction of a new surgical pavilion at the hospital with which he is connected, the author has had to formulate definite opinions on the details of construction and management of the operating theater. The problems of sterilization, the type of instruments to be used, the linen, suture material and the thousand and one minutiae, which every surgeon expects in the operating room without knowing in particular how they are prepared, are discussed in this little work with a thoroughness and conciseness which should recommend it both to the surgeon and to the hospital executive. The work is the crystallized thought of many years of active surgical practice and the opinions are practical.

Dringliche Operationen. By Prof. Dr. Alexander Tietze, Primärarzt am Allerheiligenhospital in Breslau. Ed. 2. Cloth. 8vo. Price, M. 33. Pp. 872; 384 illus., some col. Stuttgart: Ferdinand Enke, 1927.

This volume on "urgent operations" is concerned not only with traumatic surgery but also with conditions of any sort in which the

indications for operation are urgent or in which the consequences of surgical interference are apt to be especially serious. Large portions of the work are devoted to a discussion of the problems of war surgery.

The first part of the work is dedicated to a discussion of problems of general interest, such as the type of narcosis, transportation of the injured, infections and technique. The second part of the work is devoted to a description of the injuries of the various organs of the body. No attempt is made to outline the steps of the surgical procedures. The author confines himself to a description of the indications for operation and a discussion of different symptom-complexes. Numerous illustrative case histories are interspersed and many good photographs and schematic drawings enliven a very easy reading, interesting text.

DIE CHIRURGIE. Eine zusammenfassende Darstellung der allgemeinen und der speziellen Chirurgie. Ed. by Prof. Dr. M. Kirschner and Prof. Dr. O. Nordmann. Part 13. DIE CHIRURGIE DES GESICHTS, DES OBERKIEFERS UND DES UNTERKIEFERS, EINSCHLIEBLICH DER ZÄHNE. By Prof. Dr. R. Klapp, Dr. F. Bange and Priv.-Doz. Dr. F. Ernst, Berlin. DIE CHIRURGIE DER NASE UND DER NEBENHÖHLEN. By Prof. Dr. H. Beyer, Berlin. 8vo; Pp. 399; 410 illus., 5 col. pl. Berlin: Urban & Schwarzenberg, 1927.

In this installment of the new system of surgery the standard of excellence established by the previous authors is maintained. The concise yet complete presentation of the different surgical conditions is preceded by an excellent chapter on the anatomy and embryology of the part under discussion. In its very nature, the subject of surgery of the face, the mandible and the maxilla predicates the ability to restore the contour of the part injured in the surgical manipulations. This part of the work is described in a particularly interesting and able manner.

BOOKS RECEIVED

SOUTH AMERICA. Amplified to Include all of Latin America; The Vandyck Cruise. By Franklin H. Martin, C.M.G., D.S.M., M.D., LL.D., F.A.C.S.; Director-General, American College of Surgeons; Editor, Surgery, Gynecology and Obstetrics; President, Gorgas Memorial Institute of Tropical and Preventive Medicine, Inc. Revised Ed. 8vo. Cloth. $3.00. Pp. 435; illus. N. Y.: Fleming H. Revell Co., 1927.

A TEXTBOOK OF EXODONTIA. (EXODONTIA, ORAL SURGERY AND ANESTHESIA.) By Leo Winter, D.D.S., Prof. of Oral Surgery, N. Y. Univ. College of Dentistry, etc. 8vo. Cloth. $7.50. Pp. 364; 329 illus. St. Louis: C. V. Mosby Co., 1927.

BEOBACHTUNGEN UND ERGEBNISSE BEI EINER FÜNFJÄHRIGEN FRAKTURENBEHANDLUNG. (Klinische und unfallmedizinische Feststellungen). By Dr. Hans Scheffler, Assistenzarzt am Krankenhaus Bergmannsheil in Bochum. 8vo. Cloth. M. 3. Pp. 85; 18 illus. Berlin: Julius Springer, 1927.

THIS BUSINESS OF OPERATIONS. By James Radley. 16mo; Pp. 96. Cincin. Digest Publishing Co., 1927.

OUR OWN AND OUR COUSINS' EYES. By Thomas Hall Shastid, M.D., F.A.C.S., LL.D. 8vo; Pp. 199. Southbridge, Mass.: American Optical Co., 1926.

MINERAL WATERS OF THE UNITED STATES AND AMERICAN SPAS. By William Edward Fitch, M.D., Assistant Gynecologist, O.P.D., Presbyterian Hosp., N. Y. 8vo. Cloth. $8.50. Pp. 799; illus. Phila.: Lea & Febiger, 1927.

PROGRESSIVE MEDICINE. A Quarterly Digest of Advances, Discoveries and Improvements in the Medical and Surgical Sciences. Ed. by Hobart Amory Hare, M.D., LL.D., Prof. of Therapeutics, Materia Medica and Diagnosis, assisted by Leighton F. Appleman, M.D., Instructor in Therapeutics, Jefferson Medical College, Phila. Vol. 1, March, 1927. 8vo. Pp. 294. Phila.: Lea & Febiger, 1927.

INFECTIONS OF THE HAND. By Lionel R. Fifield, F.R.C.S. Surg. Registrar, First Assistant and Demonstrator of Anatomy, London Hosp. 12mo. Cloth. $3.25. Pp. 192; 2 col. pl., 67 illus. N. Y.: Paul B. Hoeber, Inc., 1927.

TRANSFUSION OF BLOOD. By Henry M. Feinblatt, M.D. Assistant Clinical Prof. of Med., Long Island College Hosp., Brooklyn, N.Y. 8vo. Cloth. $3.00. Pp. 137; 24 engrav. N. Y.: Macmillan Co., 1926.

A STATISTICAL SURVEY OF THREE THOUSAND AUTOPSIES. From the Department of Pathology of the Stanford University Medical School. By William Ophüls, M.D. Vol. 1, No. 3. 8vo. Paper. $2.50. Pp. 246; 16 charts. Stanford Univ. Press, 1926.

THE ARTIFICIAL LIGHT TREATMENT OF CHILDREN. In Rickets, Anaemia and Malnutrition. By Katherine M. L. Gamgee, M.R.C.S. (Eng.), L.R.C.P. (Lond.), D.P.H. (R.C.P.S.). Formerly Ass't Medical Officer of Health for Maternity and Child Welfare, Hull. Introduction by Prof. Leonard Hill, M.B., F.R.S., Director, Dept. Applied Psychology and Hygiene, National Institute for Medical Research. Cloth. $4. 8vo. Pp. 192; 16 pl., 5 ch., 33 text illus. N. Y. Paul B. Hoeber, Inc., 1927.

THE QUARTZ MERCURY VAPOUR LAMP. Its Possibilities and Uses in Public Health and General Practice. By J. Bell Ferguson, M.D., D.P.H., Medical Officer of Health, Tuberculosis Officer and School Medical Officer, County Borough of Smethwick. Introduction by Sir Henry J. Gauvain, M.A., M.D., M.C. Medical Supt., Lord Mayor Treloar Cripples Hospital. 8vo. Cloth. $2.50. Pp. 118; 38 illus. (13 pl.). N. Y. Paul B. Hoeber, Inc., 1927.

PROGRESS IN SURGERY

Selections from Recent Literature

FREEDLANDER, SAMUEL OSCAR, Cleveland. The treatment of tetanus. *Ann. Surg.*, March, 1927, lxxxv, 405.

Twenty-five consecutive cases of tetanus were treated with large frequently repeated intravenous injections of antitoxin, with a mortality rate of 36 per cent. Eleven of these had an incubation period of less than ten days with a mortality rate of 45.5 per cent. If the six cases which died before sufficient antitoxin could be administered are excluded, the mortality rate would be 12 per cent. The relatively low mortality rate in this series adds to the impression that tetanus antitoxin given in large doses intravenously has some therapeutic value.

TEACHENOR, FRANK R., Kansas City. Intracranial complications of fracture of skull involving frontal sinus. *J. Am. M. Ass.*, March 26, 1927, lxxxviii, 987.

Sixteen cases of fractures of the skull involving the frontal sinus are reviewed. Teachenor divides these cases into two series of eight each. In the first series there were three operations, but they were done after the onset of the complications. In the second series prompt operation was done in each case as a preventive measure. In the first series of eight patients, there were seven deaths. Two died from brain injury accompanying fracture; one of intradural frontal abscess; one of extra-dural abscess and meningitis, and three of meningitis. In one case of cerebrospinal rhinorrhea the patient recovered. In the second series of eight patients, there were three deaths. Two died from brain injury accompanying fracture, and one of meningitis; five recovered without intracranial complications. In the first series the gross mortality was 87.5 per cent; 25 per cent was from brain injury accompanying the fracture of the skull, and 76.5 per cent resulted from intracranial infection; 12.5 per cent recovered. In the second series all the patients had prompt frontal sinus drainage. The gross mortality was 37.5 per cent; 25 per cent was from brain injuries accompanying the fracture of the skull, and 12.5 per cent from intracranial infection. The one death from meningitis was the result of delayed operation. The death from meningitis twenty-nine hours after injury, and the failure to save the patient by operation thirty-six hours after injury, illustrate the necessity of early diagnosis and operation. In addition to drainage of the sinus, a free exit must be provided for air forced into the sinus from the nasal cavity. In cases of cerebrospinal rhinorrhea or pneumocephalus the dural lacerations should be sought and closed.

MAES, URBAN, New Orleans. Some conclusions on cranial injuries. *South. Med. J.*, March, 1927, xx, 178.

While the immediate recovery of the patient is a serious consideration, the remote consequences of the injury are equally important. The subtemporal decompression devised by Cushing is the most valuable measure in these conditions; it should never be done during the period of shock, and it is wise to supplement it by lumbar puncture or by the use of dehydrating agents. In mild cases lumbar puncture alone may be adequate, but expectant treatment is seldom justified.

OLIVECRONA, HERBERT, Stockholm. On section of the root of the trigeminus at the pons. *Acta Chir. Scandinav.*, Feb. 22, 1927, lxi, 371.

In cases of trigeminal pain due to intracranial or extracranial involvement of the fifth nerve by malignant tumors of the nasopharynx root, section is recommended. The temporal route for section of the root of the fifth nerve should not be used since the tumor may involve the ganglion itself or its neighboring structures. The operation of choice is an intradural approach from a suboccipital craniotomy and section of the root at the side of the pons.

PRICE, JOHN W., JR., Louisville, Ky. Treatment of infections of the face. *Ann. Surg.*, March, 1927, lxxxv, 329.

The treatment of infections of the nose, upper lip and upper part of the face may be outlined according to the degree of the infection.

The First Stage. The initial lesion is usually confined to a hair follicle, sebaceous gland or sweat gland. It appears circumscribed and superficial. The skin is red, slightly swollen, edematous, hard and tender for twenty-four hours. During the following day a central point, the size of a pin-head, becomes necrotic and appears yellow beneath the epithelium.

The treatment of this stage consists largely of "don'ts." Don't squeeze; don't pick; don't cut. One should carry a bottle of alcohol in his pocket and apply the alcohol to the infected areas every hour, or a drop of mercurochrome may be applied two or three times a day. After another twenty-four hours the process is definitely localized in most cases. The necrotic area may be opened with safety. Alcohol or mercurochrome may be applied, and resolution occurs.

The Second Stage. The second stage, the period of extension, develops when localization fails to occur, or as is usually the case, after the infected area has attracted the patient's attention, and either he or his physician squeezes, picks, or cuts into it. Within twenty-four hours the infection invades the neighboring hair follicles and glands. A carbuncle is developing. A wide area of surrounding tissue is swollen, edematous, infiltrated. Pain is intense. If a lip is involved it becomes two or three times its normal size. The skin is purplish red. About the central necrotic focus, the tissues are very hard and tender. If it has been opened there is almost no discharge. A small gray slough is visible. It is this condition which has led so many physicians into using a knife at once, and on finding no free pus to squeeze the tissues or to probe them. The earlier incision, squeezing and probing not only fails to give relief but causes a further rapid spreading of the infection, and frequently results in a fatal thrombophlebitis of the facial vein, or septicemia.

The patient's powers of resistance should be reinforced by feeding. The local treatment is divided into two stages. During the first few days the one or more necrotic points are kept open, and compresses saturated in 4 per cent salt solution are applied every hour and kept constantly wet day and night by fresh salt solution being added to the gauze with a dropper every fifteen minutes. (The gauze is so small that it tends to dry in this time. Large gauze compresses are to be avoided because their weight interferes with the superficial circulation and also because large compresses are painful.)

The second stage of the treatment begins when the process has become localized and liquefaction has advanced. Now is the time when small multiple incisions may be made to connect the multiple openings toward the center. Small bits of gauze are inserted to keep the skin edges apart, and to maintain drainage. The compresses are continued as before until healing has occurred.

By this method of delayed operative interference the incisions are confined to the walled-off zone, cutting into veins which are not blocked is avoided, and the chief danger of a carbuncle of the nose, upper lip, or upper part of the face, namely, septicemia or a thrombophlebitis and embolism of the facial vein is lessened.

The Third Stage. If the patient is seen for the first time in the third stage of the process, with thrombosis of the cavernous sinus, meningitis or septicemia, the case is, in all probability, hopeless. Nothing will be gained by multiple incisions.

GARRETSON, W. T., and COSGROVE, K. W., Detroit. Ulceration of the cornea due to Bacillus pyocyaneus. *J. Am. M. Ass.*, March 5, 1927, lxxxviii, 700.

Sixteen cases originating in the same industrial plant are reported. First aid care and treatment were given, including removal of adherent foreign bodies, foreign body stains and loose foreign bodies from the cornea and conjunctival sac. Irrigation with a 4 per cent boric acid solution and instillation of 10 per cent neosilvol followed removal in each case. A pad was placed over the injured eye for twenty-four hours. The ulcers developed from one to four days following the injury. In this series, three cases did not present an abrasion of the cornea which could be recognized macroscopically. The remaining injuries were not of a penetrating nature. Small particles of emery or débris were adherent to the cornea, which resulted in loss of epithelium. In rabbits infection of the cornea was not possible by inoculation of an abrasion produced experimentally. To obtain similar serious sequelae, the bacteria had to be injected between the layers of the cornea. In an attempt to discover the source of the infection, a careful survey of the positions held by the men was made. Only two were working in the same part of

any building (foundry). Another two men were from the same department. The remaining men were scattered over the plant in widely separated buildings. The only place where all the men had congregated was the first aid hospital. A careful survey made here did not disclose any definite focus. Cultures taken of the boric acid used were negative.

Flynn, Charles W., Dallas. Primary endothelioma of cervical lymph-nodes. *Ann. Surg.* March, 1927, lxxxv, 347.

Primary endothelioma of the cervical lymph-nodes is a more common neoplasm than is generally supposed. The disease is limited to one or a small group of glands, more commonly the superficial cervical lymph-nodes of the anterior triangle than the more inaccessible cervical glands. Biopsy is the only reliable method of diagnosis at this time and even that requires the services of a highly competent pathologist. A suspicious tumor of the neck should always be subjected to biopsic diagnosis early in its development.

If an early diagnosis of primary endothelioma of the cervical lymph-nodes is made and it is determined that it is not the generalized form, an operation immediately and properly performed will probably result in complete cure.

Brenizer, Addison G., Charlotte, N. C. Thyroiditis accompanied by hyperthyroidism. *Ann. Surg.*, March, 1927, lxxxv, 339.

Brenizer reviews the literature on this subject, reports five cases and draws the following conclusions:

1. Thyroiditis is rare, probably ½ to 1 per cent of all operative material and ¼ to ½ per cent of all observed clinical cases.

2. The two most frequent proved types of inflammation are tuberculous and woody thyroiditis. Syphilitic thyroiditis certainly occurs. Non-specific thyroiditis has shown its bacterial cause in some suppurating cases.

3. Hyperthyroidism may accompany any type of thyroiditis at any stage; usually the subacute stage. The relation in tuberculous thyroiditis is striking.

4. Most cases of non-specific and woody thyroiditis finally become hypothyroid whether operated on or not. (Difference of opinion as to this point at the Crile and Mayo Clinics.)

5. Cases of tuberculous thyroiditis operated on have given the best functional lasting results. Syphilitic thyroiditis has been received with appropriate treatment.

6. Therefore the more slowly progressive and destructive type of inflammation is more apt to be accompanied pathologically by hyperplasia and signs of hyperthyroidism and is more apt to give better functional results after operation.

7. The usual amount of thyroid should likely not be removed, even in tuberculous thyroiditis, for at least one case out of thirteen has resulted in myxedema.

McClure, Roy D., Detroit. Experiences with the thyroid problem in a Detroit clinic. *Ann. Surg.*, March, 1927, lxxxv, 333.

McClure concludes:

The use of iodine promiscuously in table salt in the effort to prevent simple goiter may be harmful. The use of iodine controlled by regular dosage is of great value in the prevention or treatment of simple colloid goiter. The use of iodine in the preparation of patients with hyperplasia of the thyroid for operation is of great value. The use of iodine in the preparation of patients with toxic adenoma for operation has been of value in McClure's clinic. He advocates the removal of simple adenomas of the thyroid as a potential source of toxic hyperthyroidism, as well as for the fact that an adenoma may be a precancerous lesion. Myocarditis with auricular fibrillation is not a contraindication to operation. Too much concern over mortality statistics may cost the life of an occasional patient who might, with operation, have had his life prolonged.

Lahey, Frank H., Boston. Successful operation in eight cases of pulsion diverticula of the esophagus. *Boston M. & S. J.*, March 3, 1927, cxcvi, 341.

The two-stage procedure and local anesthesia render removal of esophageal pulsion diverticula so safe that they should not be permitted either to attain large size or to produce obstructive symptoms before operation is sought. In the eight cases reported here, there was no mortality.

The longitudinal region just in front of the sternocleidomastoid lends itself most satisfactorily to novocaine infiltration, allowing painless exposure of the esophagus, manipulation of which produces practically no discomfort.

Another advantage of local anesthesia is that the patient may be asked to swallow, thus elevating the top of the diverticulum from its deep position and facilitating its dissection.

The most difficult portion of the dissection is the separation of the inner wall of the diverticular sac from the external wall of the esophagus to which it becomes adherent. The separation at the lowest point is not difficult, but as one approaches the neck of the sac, extreme caution is necessary. For, in order to permit thorough mobilization and implantation of the sac, the dissection must be carried completely up to the neck; yet if it is carried too far, the sac will be penetrated at the neck, and leakage result.

It is important to be sure that the sac is not pulled out so far that the esophagus is obstructed; and to insure against this error, find the point on the wall of the diverticulum sac against which the skin rests with the wound open and the esophagus demonstrated as in its midline position, and make certain that the sac is implanted in the wound up to this point.

Should it become necessary, due to obstruction, to consider tube feeding, a large catheter may be passed through the apex of the sac, guided through the neck of the sac, down the esophagus into the stomach, and leakage prevented by a purse-string suture around the tube.

The second stage of the operation (cutting the sac off) may be undertaken any time after nine or ten days, the entire sac being cut away flush with the skin. This may be done almost without pain. Estimate the length of the portion of the sac remaining in the wound and connecting the esophagus with the skin by passing the last finger down the canal until the opening into the esophagus is felt and, measuring the distance on the finger, and under local anesthesia, separate mucosa from submucosa for this distance down to the point where the neck of the diverticulum joins the longitudinal esophagus and cut away the mucosa for this distance. The wound is packed with boric ointment gauze, and feeding continued as before. Closure as a rule takes place in a few days, but in two cases with very large sacs it was not complete until three weeks after operation.

Halstead, Albert E., and Thurston, Herbert F., Chicago. The treatment of bronchial fistulas. Report of case. *J. Am. M. Ass.*, March 5, 1927, lxxxviii, 689.

In the case reported, the scar tissue lining the cavity in the chest wall and covering the exposed part of the right lung was excised, and by means of purse-string sutures of catgut the openings into the bronchi were closed and inverted. A flap of fat and fascia taken from the patient's thigh was used to fill in the cavity in the lung. A pedunculated flap of skin and muscle was placed over this fascial flap and sutured to the surrounding skin edges with black waxed silk sutures. Tension sutures of heavy black waxed silk were used to pull the skin edges together, covering the space made by the shifting of the skin flap. The fistula remained closed. The most common type of bronchial fistula is said to be the bronchopleural occurring in conjunction with pulmonary tuberculosis with tuberculous empyema. These are generally not amenable to surgical treatment. Bronchopleural fistulas occurring in the course of an empyema (non-tuberculous) generally close spontaneously when the empyema cavity closes. Irrigation of an empyema cavity in the presence of a bronchial fistula should never be practiced. In bronchocutaneous fistulas arising from abscess or gangrene of the lung, operative measures aimed at the closure of the fistula should not be attempted until the abscess cavity has closed or the gangrenous tissue has sloughed and the cavity has become clean. After the simpler nonoperative methods, such as cauterization of the tract, have failed to close the fistula, the rational procedure is to (*a*) clear the fistulous tract from its cutaneous orifice to the bronchus by sharp dissection of its epithelial lining and also the surrounding fibrous tissue; (*b*) close the opening into the bronchus by a purse-string suture through the peribronchial connective tissue and (*c*) transplant sufficient fat with fascia to fill the depression in the lungs and cover this transplant by a plastic operation on the chest wall, the transferred flap being made up of skin, fascia and muscle.

Gottesman, J., and Zemansky, A. Philip, Jr., New York. Fat necrosis of the breast. A study of twenty cases. *Ann. Surg.*, March, 1927, lxxxv, 438.

Seventy-eight amputated breasts were stud-

ied, and in fourteen of them some stage of fat necrosis was found.

The age incidence in this series ranged from nineteen to sixty years, but the majority of cases occurred in the fourth and fifth decades of life.

Six cases had general obesity and unusually fatty breasts. Two cases are definitely recorded as not obese, and in one case the patient was emaciated.

The breast was the seat of pain in six cases, in four of which the breast tissue showed some other concurrent pathological condition besides that of fat necrosis. The tumor was of stony hardness in twelve of the cases and in one case it fluctuated. Skin fixation was present in five cases, and noted as absent in seven cases. Nipple retraction occurred but once. The lesion varied in size from 1 mm. to 5 cm. in diameter and was not confined to any particular quadrant of the breast.

A positive history of trauma was obtained in only one.

The cases can be divided into four groups: (1) Fat necrosis occurring in subcutaneous tissue overlying but not involving breast. (2) Fat necrosis occuring as a single tumor mass in an otherwise normal breast. (3) Fat necrosis occurring as multiple punctate areas in a breast the seat of some other pathological process. (4) Fat necrosis occurring in a lipoma of the breast.

The authors conclude:

Fat necrosis of the breast is evidence of the response of fatty tissue to an irritant.

Factors other than trauma may explain this phenomenon.

Fat necrosis frequently occurs in association with diffuse inflammatory or cystic disease of the breast.

It is highly suggestive that the escape of fatty material from a dilated duct and its subsequent decomposition plays a rôle in the causation of this process.

Balfour, Donald C., and Henderson, Earl F., Rochester, Minn. Benign tumors of the stomach. *Ann. Surg.*, March, 1927, lxxxv, 354.

In the fifty-eight cases of benign tumor of the stomach encountered at operation the tumor was removed in fifty-seven, and exploration only was carried out in one case, that of polyposis involving the whole stomach. Patients with marked anemia were given sufficient transfusions to raise the percentage of hemoglobin to a satisfactory level and, when necessary, the operation was performed under local anesthesia. Of the thirty-six cases in which the tumor was the only lesion, the tumor was removed by excision along in seventeen, and in the remainder (except in the case of exploration) the segment of the stomach containing the tumor was resected. The situation of the tumor determined the best method of approach. The procedure used most frequently was transgastric excision through an incision in the anterior wall, and division of the pedicle by the cautery. In the larger tumors the possibility of malignant degeneration makes partial gastrectomy advisable; in at least one case carcinoma developed at the site of the attachment of the pedicle.

Judd, E. Starr, and Nagel, Gunther W., Rochester, Minn. Duodenitis. *Ann. Surg.*, March, 1927, lxxxv, 380.

The term duodenitis has been more or less arbitrarily limited to a type of chronic inflammation of the duodenum without calloused ulcers, the clinical picture of which is practically identical with that of chronic duodenal ulcer. The cause of the disease is unknown. The pathologic findings are distinctive. The association between duodenitis and chronic ulcer of the duodenum is probably close, but the exact relationship of the two lesions is not known. Gastritis and jejunitis are pathological and surgical entities and probably bear the same relationship to gastric ulcer and jejunal ulcer as duodenitis does to duodenal ulcer.

Duodenitis is a surgical and pathologic entity characterized by circumscribed or diffuse inflammation of the first portion of the duodenum without the formation of chronic ulcer. The clinical picture and roentgenological data are almost identical with those of chronic duodenal ulcer. No niche is seen in duodenitis. The association between duodenitis and chronic duodenal ulcer is close. All chronic ulcers probably originate from duodenitis. The reason why duodenitis is not always followed by chronic ulceration has not been determined. Gastritis and jejunitis are surgical and pathological entities, the full significance of which is not known.

Olch, Isaac Y., St. Louis. Chronic cholecystitis. An analysis of 100 consecutive cases diagnosed with cholecystography and treated

by cholecystectomy, in which the end results were investigated. *Am. J. M. Sc.*, March, 1927, clxxiii, 368.

One hundred consecutive cases of chronic cholecystitis are reviewed in which the cholecystogram was used in the diagnosis and in which cholecystectomy was done.

Extensively scarred and thickened gall bladders, with or without stones, represent the end stage of a long-standing disease.

These can usually (70 per cent) be diagnosed by careful history and physical examination.

Cholecystography in these cases has been an infallible corroborative laboratory procedure.

Cholecystography is an index of physiological function of the gall bladder and with this in mind cholecystitis can be detected long before marked gross changes have occurred in the gall bladder.

In every case so diagnosed cholecystectomy has resulted in complete relief of symptoms.

Chronic hepatitis is constantly associated with chronic cholecystitis, no matter how slight the latter may be.

Bailey, Hamilton, England. The clinical aspects of acute pancreatitis. *Brit. M. J.*, Feb. 26, 1927, i, 367.

An outstanding feature, which helps to differentiate pancreatitis from other acute intra-abdominal inflammations, is the almost complete absence of rigidity of the abdominal wall. This is accounted for by the fact that preoperative general peritonitis is absent.

Cyanosis is a fairly common accompaniment of the most acute forms of this disease; it is most marked in the cervicofacial region. The cyanosis is undoubtedly due to the profundity of the toxemia.

Dott, Norman M., Edinburgh. A simple method of intestinal anastomosis illustrated by three diverse cases of its application to the large intestine. *Edinb. M. J.*, March, 1927, xxxiv, 55.

The successful construction of Eck's experimental venous fistula depended on the method to be described.

The procedure is applicable to lateral and end-to-side unions; it is not available for end-to-end anastomosis. The viscera to be anastomosed are laid together and united as usual by a line of sutures representing the posterior seromuscular layer. The proposed opening in each viscus is then outlined by an incision which divides the seromuscular layers and lays bare the submucous tissue. The edges of these incisions retract, exposing a strip of intact mucous membrane. The posterior lips of these incisions are now united by sutures, each stitch embracing the cut seromuscular margin and underlying submucous tissue. In this way all blood vessels of any size are included by the stitches, and the mucous membrane is securely anchored to the outer coats along the suture line. The important step in the procedure is now taken. A sufficiently long needle, carrying a length of No. 60 commercial linen thread, is entered through the exposed mucous membrane to the lumen at one end of one of the incisions. The needle is passed along the lumen and brought out at the other end of the incision. The same needle is passed along the lumen of the other viscus in a similar way but in the opposite direction. The two layers of mucous membrane, which will form a septum between the viscera when the anastomosing sutures are completed, are thus encircled by the loop of thread, the free ends of which protrude at one end of the anastomosis. The anterior layers of suture are not inserted. The inner takes the anterior cut edges of the seromuscular layer and the underlying submucous tissue, again controlling all large vessels and fixing the mucous membrane. The outer is a simple inverting seromuscular suture; it is carried to the extremity of the anastomosis from which the linen threads protrude. At this point one stitch is left uncompleted. The linen thread is now used in the manner of the Gigli wire saw and the layers of mucous membrane which it includes are easily and rapidly divided. The continuity of the lumina is thus established. The loop of linen thread comes away as the mucous section is completed. The final stitch is inserted over the point from which the cutting thread escaped, thus completing the operation. The cutting thread should be the rough commercial article, which acts better as a saw than smooth surgical thread; its integrity should be carefully tested before its insertion, since the establishment of the lumen depends upon it.

The procedure is also useful in end-to-side anastomosis of the small to the large intestine. It involves the open exposure of the lumen of the small intestine and the application of a controlling clamp to it. The much more infective lumen of the colon is preserved intact until the anastomosing layers are completed

and it is then opened by the cutting linen loop which has been inserted round it.

Olsson, Yngve, and Pallin, Gustaf, Kristianstad. The roentgen appearance of acute intussusception. (Über das Bild der akuten Darminvagination bei Röntgenuntersuchung und über Desinvagination mit Hilfe von Kontrastlavements.) *Acta Chir. Scandinav.*, February 22, 1927, lxi, 371.

The authors relate four cases of intestinal intussusception in children where characteristic roentgen pictures were obtained by opaque enemas; a central non-filled area of the intestinal lumen corresponded to the intussusceptum.

In three of the cases reduction was obtained by increasing the pressure of the enema without anesthesia.

Leas, R. D., Cleveland. Myositis of rectus abdominis muscles contrasted with acute intraabdominal conditions. *Am. J. M. Sc.*, February, 1927, clxxiii, 270.

Myositis of the abdominal muscles assumes considerable importance because of its possible confusion with suspected intra-abdominal disease. Leas reports two typical cases. The diagnosis was based on the following findings:

1. Activation of the rectus muscle was painless.
2. Stretching of the affected muscle caused exquisite pain.
3. Palpation of the relaxed muscle gave little pain, but of the activated muscle a considerable degree of pain.
4. There was no disturbance of sensation over the affected areas.
5. The administration of salicylates gave relief in a very short time.

Moschcowitz, Eli, New York. Pains of parietal origin simulating visceral disease. *J. Am. M. Ass.*, March 19, 1927, lxxxviii, 897.

Abnormal conditions of the trunk parietes may simulate visceral disease.

Exclusive of gross anatomic changes, these conditions are: arthritis of the costochondral joints; the neuritis of herpes zoster in the preexanthematous stage; "slipping" rib; epigastric hernia, and muscular pains. Of these, muscular strains are by far the commonest.

The distinguishing feature of these pains of parietal origin is that they are profoundly influenced by bodily movement and rest.

A differential diagnosis between pains of parietal and of visceral origin is usually possible without the aid of laboratory methods.

The cause of these pains, as a rule, is a strain, either acute or repeated: in many cases, however, it is not easily fathomed.

Visceral lesions often affect adjacent muscles, and one must be on one's guard not to overlook visceral disease.

Hunner, Guy L., Baltimore. Ureteral stricture: The etiology, diagnosis, pathology and treatment of a new abdominal syndrome. *Am. J. M. Sc.*, February, 1927, clxxiii, 157.

Because of the early diagnosis and surgical treatment of most cases of appendicitis, and because of the neglect of proper diagnosis in most patients suffering with ureteral stricture, Hunner states that today ureteral stricture as a source of incapacity and morbidity ranks equally with or perhaps above appendicitis. Ureteral stricture as treated, or rather, as neglected today, is not only responsible for the physical discomfort and incapacity which it directly causes, but must also be charged with the results of mistaken diagnoses.

Simple inflammatory stricture due to a focal infection in some other part of the body is so overwhelmingly frequent, when compared to stricture from all other causes, that Hunner believes that the disease usually originates from some such focus. The acute infectious diseases of childhood probably leave inflammatory areas in the ureter, the results of which may not be apparent until later in life. Any localized acute or chronic inflammatory process may finally lead to ureteral stricture. Carbuncle, onychia, intestinal, gall bladder, appendix, and bone inflammations probably each account for a certain percentage of stricture cases; but Hunner's experience seems to point to the infections about the head as causing by far the largest number of inflammatory conditions in the ureteral wall. The physician who keeps this disease in mind, when considering any vague abdominal disorder, is surprised at the frequency of its occurrence, and at the ease with which a fairly certain diagnosis is made without the aid of the urologist.

Probably every man with a reasonably large practice has one or more of these patients on his visiting list, patients who for the most part have been consigned to the group of neurasthenics supposedly in the enjoyment of miserable health. Some of these are decorated

with a half dozen laparotomy scars. Others have tried the skill of gastrological confrères and are still complaining of vague abdominal pains, accumulations of gas, or perchance a continued mucous colitis. Others are wearing the orthopedic harness to relieve the back, hip and thigh pains. Some have been sentenced to one or more terms at Saranac, Asheville, or Colorado, in spite of the fact that the most exhaustive clinical methods have failed to reveal signs of tuberculosis, and the patient still complains of a vague indefinite backache located higher than the usual kidney ache, a slight daily rise of temperature, and general malaise and asthenia.

And yet the general practitioner, if he so wills, can learn tomorrow, almost to a certainty, and without the help of a urologist, whether or not one of these trying patients has ureteral stricture as the physical foundation for the so-called neurasthenic condition.

In about 75 per cent of these cases there is a history of bladder trouble. This may be so slight that the patient has not mentioned it, and on the direct question may answer that she has no bladder symptoms, only a slight frequency when she gets nervous or excited, or a frequency at the time of the menstrual period, or in association with a "cold" or sore throat, or with an arthritic attack. There are all grades of bladder distress up to the condition of complete incontinence.

In 20 per cent of stricture patients, there is a chronic pyelitis on one or both sides, and the urine will give characteristic findings. In 50 per cent only a few erythrocytes, a few leucocytes, albumin from a slight trace to a large quantity, or casts, or a combination of these elements will be found. In the remaining 30 per cent of stricture cases, the urinalysis is completely negative. The kidney above a stricture is usually, but not always, tender. Even when the kidney cannot be felt, tenderness in the upper flank will usually be elicited.

Palpation of the ureter where it crosses the pelvic brim practically always elicits tenderness in stricture patients. Frequently the patient will refer discomfort so caused to the epigastrium and complain of nausea, or "that old gas pain"; or the discomfort is referred down the ureter to the "ovaries" or to the bladder with a desire to void.

Palpation of the ureter in the broad ligament region usually distinguishes the area of greatest tenderness. Dyspareunia in the majority of cases is due to the presence of ureteral stricture, and "ovarian neuralgia" is probably more often a ureteral than an ovarian pain.

The chief interest to the pathologist centers in a study of the renal lesions caused by the presence of ureteral stricture.

The treatment is usually non-surgical and consists in relief of the local symptoms and improvement in the kidney function, by dilatation of the stricture area and restoration of adequate renal drainage. Treatment often fails to give permanent relief until the original focus of infection is eradicated.

McGuire, Stuart, Richmond. Use of appendix vermiformis in the formation of a urethra in hypospadia. *Ann. Surg.*, March, 1927, lxxxv, 391.

McGuire has three times used an appendix, stripped down to its submucosa, as a graft to form an artificial urethra. It worked well in all three cases although the graft was from other individuals.

Lewin, Philip, Chicago. Disturbances of the metatarsal arch. *J. Am. M. Ass.*, March 26, 1927, lxxxviii, 994.

Lewin stresses the fact that diathermy, negative galvanism and sinusoidal current are helpful adjuvants in the treatment. Plaster of Paris casts are frequently indicated in the treatment of metatarsalgia. Less frequently is operation necessary. The various operations in this region are tenotomy, tenodesis and tendon transplantations, such as the Jones or Sherman operations. Hoffman's operation, consisting of removal of the metatarsal heads, should be reserved for extreme cases, in which it is most valuable. Arthrodesis of the metatarsal joints is rarely indicated. Likewise, arthroplasty can be performed. Hallux rigidus, whether of the flexus or the extensus varieties, may be relieved by the insertion of a thin strip of steel the entire length of the sole of the shoe, in order to prevent movement at the metatarsophalangeal joint. True gout is not seen very often at present, but there is a very definite condition of arthritis and periarthritis occurring in the region of the big toe joint that is either caused or aggravated by disturbances of metabolism, especially the metabolism of meat, fish and eggs.